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SCIENCE AND THE NEW EUROPE

FOR some weeks past, much paper and ink have been expended in discussing the war aims of the Allies. Although the British and French Premiers and others have declared repeatedly and on various occasions that the purpose of the Allies is to put an end to the constant aggressions of Germany, in the interests of peace among the European peoples, there are those who feel that, as thus stated, Allied aims are not sufficiently defined. Hence there is frequent difference of opinion as to whether, in arriving at the terms of a peace, it will be possible to discriminate between the Nazi Government and the German people. In this connexion, Mr. Chamberlain's restatement of the aims of Great Britain and her Allies in his broadcast of November 26 as "the defeat of that aggressive, bullying mentality which seeks continually to dominate other peoples by force, which finds a brutal satisfaction in the persecution and torture of inoffensive citizens, and in the name of the interests of the State justifies the repudiation of its own pledged word whenever it finds it convenient" should allay all doubt.

So clear and comprehensive a summing up of the forces to which the Allies are opposed, and to which they are determined to put an end, be they Nazi or characteristic of the German people at large, leaves no room for ambiguity or extenuation. In the pages of NATURE, however, and with the advancement and interests of scientific truth more especially in view, it is permissible to phrase our objective in even more precise terms without essential modification of substance, yet at the same time clarifying the issue. To every man of science it should be an article of faith that any view of the State and of the duty of the citizen to that State which require from the research worker, the man of science, or the teacher the distortion of scientific evidence, the suppression of any scientific truth, and the elimination of all freedom of thought which runs counter to the prevailing political theory, are abominations which must be destroyed, root and branch. Continental commentators on the war aims of the Allies, who are close observers of the German scene both at the moment and in historical perspective, have pointed out that while the German philosophy and mentality function in terms of 'power', Great Britain and France are thinking in terms of 'liberty'. Although the German people have been moulded by the Nazis to the ends of 'power politics' more drastically than ever before, it is no doctrine of to-day or yesterday. It goes far back in the history of the German people. How this should bear upon the attitude of those who have at heart the true interests of scientific thought and the advancement of scientific knowledge it is perhaps unnecessary to inquire. The moral is obvious.

Contributions to the recent discussion of war aims have brought to light many interesting differences of opinion and diversity of view. The 'New Europe' of which Mr. Chamberlain spoke is not one in which the map has been redrawn according to the ideas of the victors, but a Europe in which "the nations which inhabit it will approach their difficulties with good will and tolerance". Mr. Chamberlain went on to define the conditions of lasting peace as involving in the first place a full and constant flow of trade between the nations concerned, with an increased interchange of goods and services by which the standard of living could be improved; secondly, that each country would have the free and unfettered right

to choose its own form of internal government, so long as that government did not pursue an external policy injurious to its neighbours; and thirdly, that in Europe armaments should be dropped as a useless expense, except in so far as needed for the preservation of internal law and order. As a corollary, he contemplated as necessary some machinery capable of conducting and guiding the New Europe in the right direction. Not unnaturally, Mr. Chamberlain did not feel called upon, nor indeed did he think it possible at this stage, to specify the kind of machinery which should be established for this purpose.

Although Mr. Chamberlain's foreshadowing of the possible course of post-War events must be still fresh in the minds of all, it is perhaps not superfluous that it should be recapitulated here. For the man of science this forecast bears a special significance. To him as a citizen it carries—as indeed it does to all—a message of promise and hope at a time when the very foundations of honour and decency of life in a civilized community are under grave threat. But for the man of science in the exercise of his special function as one whose work directly or indirectly comes ultimately to bear on the better organization of civilized life and its amenities, Mr. Chamberlain's words convey a deeper implication, and in a two-fold sense. Of all the forces which in the interval between the last and the present War have made for international co-operation and mutual understanding between peoples—an essential condition of lasting peace—few have been more effectual than science. This has been due not merely to the effect produced by co-operation in research and the pooling of results, but it has arisen also out of the manner in which science has devoted itself to a world-wide, objective and impartial study of certain facts, and the application of the results of such study in efforts to raise the general standard among peoples in such matters as nutrition, personal and social hygiene, conditions of labour, production and exchange, and a hundred and one other problems which vitally affect the well-being of communities and the happiness of their members. As must be inevitable after a great war, the need for these services will be intensified at the close of hostilities, and it may be assumed that to cope adequately with the conditions which will then prevail will demand a gigantic effort in which international co-operation alone will be equal to the strain.

More immediately, however, in Mr. Chamberlain's New Europe it will be incumbent upon science, and more especially the biological and humanistic sciences, to place their knowledge, their methods of inquiry, and the results of their research at the disposal of the friendly conferences of which Mr. Chamberlain spoke, when they meet to adjust boundaries, to discuss the economic problems of productions, currency and exchange, and to consider those other problems with which they will have to deal to ensure the lasting peace for which we hope. It is equally essential that this body of specialized scientific knowledge should be at the service of that body, or machinery, which is to guide the development of the New Europe, whatever may be its form and whatever the authority which it may carry to enable its rulings to prevail. Only on this condition and by the utilization of such specialized knowledge to the full will it be possible to avoid the mistakes of a second 'Versailles'.

Political philosophies have alternated between 'force' and 'consent' in their analyses of the forces which contribute to the origin and growth of societies. Possibly a happy compromise between the two has in most instances brought about some state of equilibrium, a generally acceptable way of living. If force—the big policeman—is necessary to coerce the criminal, the perverse, and the members of an intractable minority, it is a force wielded in the interests of, and with the consent of, the majority. The preponderance of that majority and the unanimity of its consent to the exercise of force both as an instrument of, and as embodied in, law and order, must depend upon the recognition of a number of common aims among the members of the community and the extent to which each individual is prepared to curb his idiosyncrasies, should there be any to which the curb should be applied in the interests of other members. The same applies, or perhaps it would be more correct to say it is an ideal which should apply, in the relations between States and peoples. For it is the teaching of anthropology that each people, each national group, has its idiosyncrasies, like an individual—idiosyncrasies which are the product of a long history of cultural development in Europe going back to the Dark Ages, and indeed far beyond. Further, we learn from such studies that such a cultural heritage in the long run never submits to force, but itself vanquishes force in the end. Such modification as the cultural heritage may undergo in the course of development—and it is unquestionable that such transformations in

the ethnic group have taken place on many occasions—this is brought about by cultural contact and cultural exchange no less than by the course of an internal cultural evolution (to use the term evolution in its more popular sense). Is this the solution of the German problem, the problem which to some seems insoluble without a change in the heart of that people as a whole, but of which at present there seems little prospect?

The major problem of the post-War world will be the reconciliation of the cultural heritage, the national spirit of each ethnic group, with the common aim of a New Europe. If the guiding body or machinery of which Mr. Chamberlain spoke is to avoid the error of an earlier settlement, study of the problem which respects cultural and ethnic history must be invoked toward a solution. Then it may be possible to ensure international co-operation in a maximum of joint effort towards those common aims to which science, among other social forces, will point the way. The greater the common field in which co-operation can be brought about, the less the need is likely to arise of coercing the recalcitrant and the aggressor by the threat of the big policeman—a major European war.

AMERICAN MINERAL DEFICIENCIES

Strategic Mineral Supplies

By G. A. Roush. Pp. xvii+485. (New York and London: McGraw-Hill Book Co., Inc., 1939.) 33*s*.

AS a by-product of recent discussions about resources in essential raw materials, the word 'strategic' has acquired a specially limited significance in the United States. It refers to those materials which are not obtainable from within the national boundary in sufficient quantities to meet current industrial needs and therefore, in times of emergency, military necessities as well. The peace-time and war-time requirements of a modern State now differ quantitatively rather than qualitatively, and so the list of contraband materials has become extended very widely by all States.

The political atmosphere of the last six years has undoubtedly stimulated a specially intense examination of this subject, and study of the problem of self-sufficiency is naturally not an unpleasing theme to Americans; for no other political unit has so few gaps in its defences to repair; has such small difficulties in securing supplementary supplies from outside; or is so well developed in its industrial configuration to absorb and turn to marketable or military account these imported strategic raw materials. For an industrialized country deficiencies in a few minerals are more serious than any shortcomings in vegetable products, because the former are distributed over the globe in workable deposits without regard to climate or political boundaries; they cannot be made artificially; they cannot be transplanted; and only to a very limited extent, and then with some loss of efficiency, can the abundance of one material be made to make up for shortage in another.

In the United States ten minerals are listed by the War Department as 'strategic'; these are not, and are not likely, to be found there in quantity or quality to meet the demands which would certainly occur during war with any great Power. There are others officially classified as 'critical' which can probably be assembled in sufficient quantities by conservation and distribution control; they are not, as Mr. Roush says, likely "to give rise to many headaches". Then there is the much longer pleasing list of 'essential' minerals which occur in obvious abundance in the States, some with a surplus for export.

With the exception of a short final few pages on the deficiencies of the other six great Powers, this volume is limited to a study of the American ten strategic minerals—manganese ore, nickel, chromium, tungsten, tin, aluminium, antimony, mercury, platinum and mica—in addition to iodine and nitrogen, which are essential but can easily be obtained when necessary. This list also shows roughly the order of importance of these minerals for war purposes, and involuntary emphasis on the meaning of the word 'strategic' is shown by giving full consideration, in the first place, to manganese ore, the substance which gave the American steelmakers serious cause for anxiety during the War of 1914–18.

Very full data, graphically illustrated, are given for each of these minerals—the amounts required, their uses and ways of utilization, their occurrences, the partial substitutes obtainable for some of them, their outputs, prices, import tariffs and forms of control, followed in each instance by an appreciation, as the tactician would say, of the resultant domestic situation. As the editor, since 1914, of the annual publication well known as the *Mineral*

Industry, Mr. Roush has acquired a position of special authority, which his own Government has turned to further account by his appointment to the Staff Specialist Reserve of the United States Army.

The information packed by the author into 485 pages cannot be further condensed. That is one of the disconcerting features of all discussions on mineral raw materials; each mineral has its own special importance; and in an emergency, the want of any one of them may render ineffective the value of all the others. The politician's satisfaction in "looking at the question as a whole" is here of no practical value. "The problem," as Mr. Roush says in his general summary, "is not only a different one for each individual metal, but for each separate use of the metal." He takes the metal platinum as an illustration and points out that, whilst general substitutes are quite unobtainable, some cheaper substitutes can to a limited extent be used to reduce the demand for the expensive metal: fused silica can partly replace platinum in the chemical laboratory; a nickel-iron alloy can be used as a lead-in wire in electric-light globes; vanadium oxide is used instead as a catalyst in sulphuric acid manufacture. But no material has ever been found which can take the place of platinum in all its wide variety of uses. In other words, an industrialized nation *must* have platinum, for one thing; and each country has its own special list of other strategic deficiencies.

Among the alloys, however, substitution is possible to a greater extent; but again either at a higher cost or with some loss of efficiency. The institution of new alloys is now nearly a monthly occurrence, each in turn putting a predecessor out of the field under conditions of keen competition, commercial or military. So, within the territory of a highly industrialized great Power at war, the progress of scientific and technological research is more significant now than it ever was before; even from the purely military point of view it is short-sighted of any nation to decrease, for ideological reasons, its list of 'strategic' men of science.

We must, however, resist in this short review the temptation to follow up this line of thought, and refer now very briefly to some of the more direct lessons which Mr. Roush discovers in his study of the few American mineral shortcomings. He realizes that in general it is useless to encourage an increase of a peace-time production when, as in the instance of nickel and tin, there are practically no domestic natural resources to develop; that artificial efforts of the sort may add another danger if the small natural reserves are likely thereby to become exhausted. He points out the advisability, however, of a very limited peace-time activity in producing those minerals which could, when necessary, be produced in quantities substantially sufficient to reduce the dangers of a shortage during a sudden emergency. He would encourage the use, in recoverable forms, of imported metals as one way of building up stocks; for he realizes the financial burden of artificially creating stocks sufficient to cover one or two years' war supply. But this plan nevertheless seems to be the only safeguard which he can recommend, and it is apparently gaining favour in the United States since it was proposed by the Leith Committee some fifteen years ago to meet the danger of a manganese ore famine. Other than these direct measures, Mr. Roush points out the necessity of instituting a systematic and continuous accumulation of information regarding foreign sources of nearby supply, some of which might be accessible in time of war.

This leads Mr. Roush to point out the serious nature of the dangers to his own country which would follow from a war with Great Britain; but he nevertheless derives some comfort from the well-founded assumption that any such disaster is very unlikely. Great Britain too might well take note of the same danger, and for a similar reason derive the same degree of comfort; for whilst the British Empire as a whole has a shorter list of strategic minerals than any single political unit, the sources of supply are widely separated from the chief industrial area, and are now under the control of free and politically independent States which still maintain tariffs for their own immediate needs.

One lesson, often mentioned by others before, peeps out occasionally in this work—the importance, both economic and military, of smelting and refining at home, whatever be the source of the ore. As an example of the way in which the British Government learned some wisdom from the costly mistakes of the War of 1914–18, Mr. Roush quotes the subsequent action of British Guiana in granting a concession to an American company to mine bauxite, on the condition that it should be smelted within British territory, one result being the building in the Province of Quebec of the largest single aluminium plant in the world, in spite of the fact that its location is remote from the chief markets for the refined metal.

Although this volume is devoted admittedly and entirely to the consideration of direct American interests, the mass of trustworthy information which it contains indicates lessons of vital interest to those British public leaders who seem to think that as Providence has endowed the British Empire with unequalled natural resources, Providence will also arrange for their easy assembly and utilization in times of need.

T. H. HOLLAND.

PROTEIN CHEMISTRY

The Chemistry of the Amino Acids and Proteins Edited by Prof. Carl L. A. Schmidt. Pp. xxiv + 1031. (Springfield, Ill., and Baltimore, Md.: Charles C. Thomas, 1938.) 7.50 dollars.

FROM the time of Osborne's pioneer researches on the plant proteins, American chemists and biologists have shown the liveliest interest in this field of investigation, and it can safely be said that in no country to-day is a greater proportion of the total researches concerned with protein problems. Not only do American names figure prominently in the history of protein discoveries, but also for convenient accounts of the work of many European investigators, such as Sørensen and Svedberg, we are indebted to American enterprise in arranging lecture visits and to American publishers for issuing the lectures in monograph form.

The present volume represents a courageous effort by sixteen contributors, who with the exception of Prof. Gorter and his assistants Drs. Maaskant and van der Dusen are all American, to fill a world-wide need for a reference book on the amino-acids and proteins. It is in no sense a book for the beginner—but fortunately there are many such. It should be acquired by most libraries and all research workers in the protein field because it collects in the scope of one volume so much that is scattered and inaccessible, and because it embodies a wider review of the literature than any hitherto available.

In one important respect it fails, however. Whereas the individual contributions are excellent, together, they make an ill-assorted collection with notable omissions which fails to convey a sense of true perspective of the protein field as a whole. For example, Dr. Michael Heidelberger contributes a most informative chapter on proteins in immunity, but there is no adequate supporting section in the book dealing with the compounds of proteins with carbohydrates and lipoids so important in immunity phenomena. The role of proteins in nutrition receives 20 pages; their roles in respiration, and in preserving the water balance of the organism, on the other hand, are not discussed. The latest views on protein structure associated with the names of Astbury, Wrinch, Bergmann and Niemann all receive ample attention, but the chemistry of the enzymes and nucleoproteins, two fields which have developed out of all recognition in recent years, is omitted altogether.

The section dealing with the preparation of the proteins is quite inadequate. A scant 8 pages is devoted to this, which stand in marked contrast to a comprehensive description extending to 47 pages on the isolation and preparation of the amino-acids. Casein receives a paragraph in which no mention is made of Van Slyke and Baker. There are no references at all to Palmer's crystalline lactoglobulin or to Kekwick's diffusible protein in milk, or to the preparation of insulin or thyroglobulin. While the physical properties of myosin are adequately described, there is no mention of its preparation or of the other proteins in muscle.

The book is strongest in its treatment of the amino-acids and the physical chemistry of the proteins. Dr. John Edsall contributes an outstanding section extending to 80 pages on dipolar-ionic structure and the solubility relationships of the amino-acids and proteins. The section on the molecular weights of the proteins is valuable only in relation to osmotic methods of measurement. In the section on diffusion the obsolete fluorescence method of studying diffusion is described and illustrated, whereas the later technique and results of Lamm and Polson are not mentioned. The description and illustration of the Svedberg equilibrium centrifuge refers to the original model built in 1924, which was radically altered a few years later. The sedimentation velocity centrifuge is represented as improving and supplanting the equilibrium centrifuge, whereas in fact the two measure different constants and are complementary. It is a pity that in an otherwise exhaustive section on the electrochemistry of the amino-acids and proteins the new electrophoresis technique described by Tiselius early in 1937 has not been included.

The reviewer is fully conscious of the immense difficulties which face anyone courageous enough to attempt the production of a comprehensive text-book on such a rapidly developing and many-sided subject as protein chemistry. The example before us must be judged in the light of these difficulties. Whereas the book is defective in many respects and may not be compared with numerous classical works of reference in other subjects, it must be acknowledged and welcomed among protein chemists as the best available to meet their needs at the present time.

A. S. McF.

WOOD AS A RAW MATERIAL

Das Holz als Rohstoff
Seine Entstehung, stoffliche Beschaffenheit und chemische Verwertung. Von Dr. Reinhard Trendelenburg. Pp. 435. (München und Berlin: J. F. Lehmanns Verlag, 1939.) 14.50 gold marks.

FROM the earliest days of civilization, wood has ranked as an important constructional material on account of the ease with which it is obtained and worked with the simplest tools, and because it combines in a striking degree a relatively high strength with moderately low density. The wide, and only partially controllable, variations in properties which it shares with other natural products have tended in recent years to place timber at a disadvantage in competition with a number of highly standardized constructional materials now on the market. Any decline in consumption due to this circumstance has, however, been more than offset by the development of new methods of manufacture which promise to overcome the difficulties caused by variation, and by the increasing use of wood in the preparation of paper pulp, cellulose, charcoal, and other substances. The more intensive utilization in these directions calls for a fuller understanding of the origin, composition and structure of wood, and Dr. Trendelenburg's book supplies an excellent introduction to the present state of knowledge in these fields.

Most text-books of wood anatomy include detailed accounts of the microscopic structure and the preparation and examination of material, and they are designed to meet the requirements of readers primarily concerned with the identification of specimens of timber or with the grading and use of timber in situations demanding good appearance or high strength. Dr. Trendelenburg's book is largely supplementary to these; general structure and laboratory methods are dismissed in a few pages which are perhaps included merely as a matter of form, since they are probably beyond the grasp of readers not already familiar with their import, and the major portion of the book discusses structure and physical properties more particularly in relation to the use of timber in the production of secondary materials.

Two brief introductory sections describe the composition and distribution of the German forests, and give a general account of the production of timber for the benefit of readers who are not foresters; the final section has brief notes on the production of pulp, cellulose, sugar, charcoal, wood gas, wood wool, and fibre board.

The third section has descriptions of the characteristic elements and tissues, and discusses the causes and significance of variations in size of the elements and proportions of the tissues. Current methods of dealing statistically with variation, as recommended by the International Association of Wood Anatomists, are given. Reference is made to the principal chemical constituents and to recent work on the fine structure of the cell wall. The keynote of the fourth section, which deals with the gross anatomy of the stem, is given in a quotation from Nordlinger to the effect that "as the cell is to the physiologist, so is the growth ring to the scientific forester". Development of the growth ring throughout the year is traced and the various factors influencing ring width are examined. Nearly half the section is concerned with sapwood and heartwood, and the account is the best yet published.

The fifth and sixth sections, together comprising nearly half the book, are devoted to problems of moisture content and specific gravity. Both properties have an important bearing on the yield of the products listed in the closing section of the book. Variations in moisture content in different parts of the living tree are described in relation to season of the year, locality, and species. The conception of fibre saturation point as the moisture content at which the cell walls are saturated while no free water is present in the cell spaces is merely a convenient assumption for practical purposes, and reference to the recent work on the subject by Barkas would have made this interesting section more nearly complete. It may be mentioned that 'collapse' is not confined to dense timbers, as might be inferred from the text; several light, softwood timbers are very prone to collapse in drying, and with some of these reconditioning appears to be impracticable. The treatment of specific gravity is equally full and interesting.

In addition to descriptions of extensive original work, Dr. Trendelenburg refers to more than six hundred papers, more than half of which have appeared since 1930; some four hundred and sixty are in German, and the references to a large volume of early German literature are particularly valuable to English readers.

The book is well indexed, having catalogues of literature, authors, species, and subjects occupying 45 pages.

S. H. CLARKE.

NEW TECHNIQUE IN PHYSICAL CHEMISTRY

By Dr. H. W. Melville, Department of Physical Chemistry, Cambridge

MODERN physical chemistry has now such wide ramifications that it is not easy to summarize compactly its recent endeavours. A number of the newer aspects of the subject were discussed from the point of view of the invention of new technique at a meeting of Section B (Chemistry) of the British Association held at Dundee on September 1. The development of such technique is a vital part of physical chemistry, and many recent discoveries are a direct consequence of these advances.

There are in chemistry innumerable problems, often concerning well-known and simple systems, which have formed bones of contention for many years. No amount of theoretical treatment will provide a solution. What is needed is a simple and conclusive experiment to settle the question once and for all. The region for inventiveness is thus of wide scope. The problems which have arisen are mainly those having to do with the mechanism of chemical reactions, and there are essentially two reasons for this state of affairs. What may be called 'classical chemistry' has established the kinds of molecule which enter into reaction and also what sorts of products emerge therefrom. But it could only surmise what happened in the intermediate stage of events. Certainly it was known that some kind of chemically reactive molecules took part in the reaction. The trouble is, however, that the fraction of molecules involved is generally so minute that no method of analytical chemistry is sensitive enough to detect their presence, apart altogether from determining their nature. Thus in order to discover how reaction occurs, essentially different methods have to be developed to perform this difficult task. These problems only arise, of course, in relatively slow reactions; very fast reactions are still outside the scope of experimental inquiry, although progress is being made in selected cases. Another problem often arises once the general question of mechanism is settled. When a polyatomic molecule containing a number of similarly disposed atoms undergoes reaction, it is also necessary to know what particular atom is actually involved. This question is now settled with great success by isotopic methods when samples of relatively pure isotopes are available.

The first part of the general problem is by no means solved at present. In dealing with such minute quantities of various molecules, any method used to measure their concentration must not, of course, alter that concentration significantly, otherwise the mechanism may be so much disturbed that the results obtained are invalid. One of the best examples of the development along these lines is the use of *para*-hydrogen for the measurement of hydrogen atom concentrations, in those processes where atomic hydrogen is believed to play a part, as for example in the heterogeneous and homogeneous reactions of hydrides. The method has the great merit that since conversion is brought about by exchange of atoms thus:

$$H + p\text{-}H_2 = o\text{-}H_2 + H,$$

the hydrogen atom concentration is not disturbed. It may be mentioned that atomic concentrations as low as 10^{-7} mm. of mercury may be so measured.

Naturally the method is a comparative one in that the reaction being investigated is really compared with that of conversion. Suitable conditions can, however, be chosen to cover a very wide range of concentrations. One example must suffice to indicate the kind of problems that can be solved. Ammonia is decomposed by light of wave-length 2000 A. to nitrogen and hydrogen, only one molecule decomposing out of four absorbing radiation. Admixture of *para*-hydrogen shows that the primary dissociation is to H and NH_2, but only about one half of the molecules decompose in this way. This alone does not explain the low quantum yield. Another technique shows that part of the inefficiency of the gross process is due to some recombination of H and NH_2 to form NH_3, for the decomposition is inhibited by atomic hydrogen produced at a controlled rate and checked by the *para*-conversion.

Similar methods with many ingenious modifications may be applied to all homogeneous hydride reactions in which atomic hydrogen is presumed to play a part. Although the same technique may be employed in heterogeneous reactions, the addition of *para*-hydrogen sometimes alters the character of the adsorbed layer on the catalyst, and therefore makes the results more difficult to interpret.

In reactions involving halogens, atomic halogen frequently is the active species concerned, whether the reaction be induced thermally or photochemically. Fortunately, in view of the comparatively low energy of dissociation, the equilibrium constants for dissociation are known accurately, and thus stationary atom concentrations are easy to compute. If, however, there is a disturbance of the stationary concentration by any competing reaction, then both rate of production and rate

of removal of atoms must be known. It is the latter quantity that is the more difficult to measure. Two methods have been developed. One consists in actually measuring the decrease in the number of halogen molecules on illuminating the system, by an optical differential technique. The other consists in a proper examination of the expansion halogen vapour undergoes on illumination, that is, the Budde effect.

The behaviour of other reactive chemical entities such as OH, NH_2, CH_3, C_2H_5, and so on, have been examined with similar but less refined methods, and there is here much work to be done before a complete correlation of all the data can be effected. For example, the life-time of these radicals can be determined by producing them photochemically and allowing their concentration to fall in the period of darkness succeeding illumination. Again, owing to the minute concentration, the chemical result in any one dark period cannot be measured. But by employing rotating sectors a large number of identical decay periods may easily be integrated to provide the information required.

The labelling of atoms in a molecule by using isotopes—radioactive and non-radioactive—has now assumed a familiar place in chemical laboratories. Deuterium is employed in all suspected cases of hydrogen atom lability and for acid-base catalysis, enolization, mutarotation and the like. Isotopic oxygen, though less plentiful, provides the key to debated mechanisms of hydrolysis and the constitution of bound oxygen atoms in molecules. Already nitrogen isotopes have indicated the rate at which nitrogen molecules are severed on synthetic ammonia catalysts. In fact, progress in this field is only limited by the rate at which isotopes may be produced, and the variety of reactions by the kinds of isotopes available.

In principle, radioactive indicators are used in the same way. They have the advantage of being easy to detect in small quantity, but often have practical limitations in their short life-times. This practical disability, however, can be overcome by using more powerful neutron generators. The question of the ionization of carbon-halogen bonds has been tackled in this way, and the biological applications of radio-phosphorus are becoming widely known.

Thus within a matter of a few years a new branch of physical chemistry has come into being. The principles of the subject are now well established, and it will not be long before every branch of chemistry will derive benefit from these advances in physico-chemical technique.

THE RELATIONSHIP BETWEEN PITHECANTHROPUS AND SINANTHROPUS

BY DR. G. H. R. VON KOENIGSWALD, BANDOENG, AND PROF. FRANZ WEIDENREICH, PEKING CENOZOIC RESEARCH LABORATORY, PEIPING UNION MEDICAL COLLEGE, PEKING

DAVIDSON BLACK had remarked on the great similarity between the first skull of Sinanthropus to be found and the Pithecanthropus skull of Trinil, a condition which induced him to see in Pithecanthropus a Hominid form closely related to Sinanthropus (1931). The additional finds of the latter, unearthed in the interval, have confirmed Black's interpretation in every respect. But on the other hand, since the Pithecanthropus finds remained restricted to that rather incomplete specimen of Trinil, absolute evidence for his true Hominid character was lacking. In such circumstances, there was no other way open but to await the discovery of additional Pithecanthropus material before definitely solving this problem.

These discoveries materialized. Following the recovery of a rather primitive infantile skull (*Homo modjokertensis*) in 1936 and of a lower jaw of an adult individual, one of us (G. H. R. von K.), during 1937, discovered a skull in the undoubted Trinil deposits of Sangiran. This skull, preserved up to the basal region, conforms in every respect as to size, shape, and details to Dubois's Trinil specimen. Dubois, however, opposed the attribution of this skull to Pithecanthropus. Nevertheless, the details of the interior, as well as exterior surfaces of the skull, and also the skiagrams, delineating the otherwise indistinct sutures and breakage lines, show not the slightest trace of irregularity or deformation, such as would be unavoidable if the assembly of the fragments had been artificially adapted to a particular form. To this skull of Sangiran was added another skull fragment derived from the same deposits and of the same site during the summer of 1938, briefly described in NATURE of October 15, 1938, p. 715, by us. We are now in a position to report on an additional Pithecanthropus find made this year. It concerns the lower part of an upper jaw of unusually large dimensions, comprising the processus alveolares of both sides with completely preserved nasal floor and palate, the complete left

dental arch with all the teeth leading from the canine backward, and a part of the right dental arch up to the first molar. The incisors were lost, but their alveoli are preserved (see accompanying reproductions, *a* and *c*). Afterwards the skull belonging to this jaw was also found. It comprises the posterior third of the brain case, including the entire basis.

Morphologically and geologically, we believe we are justified in attributing all these finds to Pithecanthropus. This type is thus represented by the following finds:

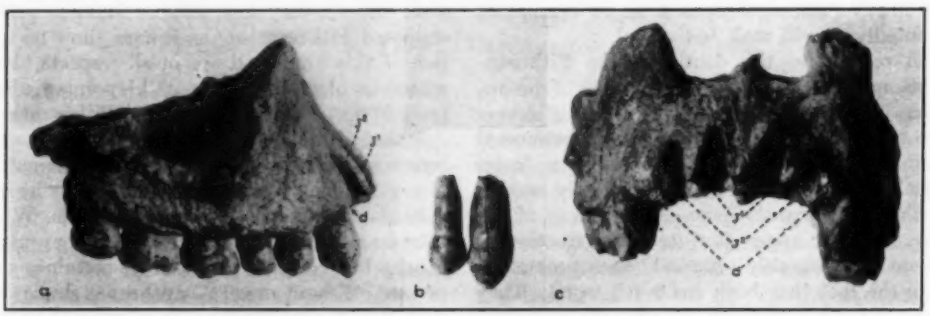
(1) Skull of Trinil (Dubois, 1891): Pithecanthropus skull I.

(2) Mandible of Kedung Brubus (Dubois, 1891): Pithecanthropus mandible A.

(3) Juvenile skull of *Homo modjokertensis* (Geol. Survey 1936)*.

Of the Sinanthropus cranial material, skulls E and II of Locus L are most suitable for a comparison, having capacities of approximately 915 c.c. and 1015 c.c., respectively. These skulls are slightly larger than the Pithecanthropus skulls, but they are the same in general form and particularly in height.

The main differences so far as the skull cap is concerned consist in that in Pithecanthropus (skulls I and II) the supraorbital tori pass directly over to the extraordinarily flattened forehead, whereas in Sinanthropus the supraorbital ridges are much more demarcated from the tuber-like vaulted but otherwise also strongly receding forehead. On the other hand, the obelion region in Sinanthropus is flat, while in Pithecanthropus it is rounded off. The greatest similarity is seen in the general form and structure of the temporal



(*a*) UPPER JAW OF A MALE PITHECANTHROPUS (SANGIRAN, JANUARY 1939), VIEWED FROM THE RIGHT SIDE. *d*, DIASTEMA; J^1, ALVEOLUS OF J^1; J^2, ALVEOLUS OF J^2. $\frac{2}{3}$ NAT. SIZE.

(*b*) UPPER RIGHT CANINE AND FIRST PREMOLAR OF A MALE INDIVIDUAL OF SINANTHROPUS (*F* IV), SO AS TO DEMONSTRATE THE PROTRUSION OF THE CANINE. $\frac{2}{3}$ NAT. SIZE.

(*c*) THE SAME AS (*a*) BUT VIEWED FROM IN FRONT. $\frac{2}{3}$ NAT SIZE.

(4) Mandible of Sangiran (v. Koenigswald, 1936): Pithecanthropus mandible B.

(5) Skull of Sangiran (v. Koenigswald, 1937): Pithecanthropus skull II.

(6) Skull fragment of Sangiran (v. Koenigswald, 1938): Pithecanthropus skull III.

(7) (*a*) Maxilla of Sangiran (v. Koenigswald, 1939); (*b*) Skull fragment of Sangiran (v. Koenigswald, 1939): Pithecanthropus skull IV.

The Sangiran skull (Pithecanthropus skull II) resembles the Trinil skull as closely as one egg another. The former (skull II) is only slightly smaller than skull I—its capacity being 835 c.c. as compared with 914 c.c. of the Trinil skull—but its parietal and occipital parts are relatively broader. The Sangiran fragment (Pithecanthropus skull III) is, in its preserved part, not so flat as the other two (skulls I and II), but otherwise resembles them in every detail. In addition, it bears a distinctly pronounced crista sagittalis.

* On the basis of my study of the original, I have now come to the conclusion that this infantile skull really represents a Pithecanthropus child. I shall report on this elsewhere.—F.W.

and occipital bones, and there is absolute conformity in some special details of these bones. The Pithecanthropus fragment III and Sinanthropus skull E show identical features even in apparently unessential structures. Beside the first mentioned sagittal crest, there is in the obelion region on each side of the sagittal suture a short groove which Black described and illustrated in Sinanthropus skull E.

With regard to the lower jaws, that from Kedung Brubus is characterized as representing Pithecanthropus by the exclusively basal location of a broad digastric fossa—the only usable criterion. This mandible corresponds in size and proportions to the small female Sinanthropus jaws A and H, and the mandible M II, more recently discovered, and not yet described. The jaw from Sangiran (Pithecanthropus mandible B), on the other hand, is large, and corresponds to the large male Sinanthropus jaws G I and K I, with the exception that the frontal section is considerably thicker than in the latter.

The upper jaw from Sangiran (see reproductions) has as yet nothing comparable among the Sinanthropus specimens, for the two upper jaw fragments of the latter known up to the present have much smaller dimensions and proportions, implying that they belong to female individuals, while the upper jaw from Sangiran must be ascribed to a male.

The differences in size and proportions of the upper and lower jaws of both Pithecanthropus and Sinanthropus, apparently chiefly due to sexual differences, also serve as a criterion of the cranial conditions in this respect. The lower and upper jaws from Sangiran are much too large for the small Pithecanthropus skulls I and II, whereas the lower jaw fragment of Kedung Brubus would seem to fit them better. It may be concluded, therefore, that the two Pithecanthropus skulls, regardless of their minor differences in size and thickness, must have belonged to female individuals, whereas the rather heavy Pithecanthropus skull IV represents undoubtedly an old male individual.

With respect to the dentition, the Pithecanthropus molars are larger than those of Sinanthropus available so far. But the lower incisors—so far as the size of the crowns can be estimated from that of the alveoli—and especially the lower canines of Pithecanthropus, are decidedly smaller than those of Sinanthropus. The canines of the Pithecanthropus upper jaw (see reproduction *a*) protrude considerably beyond the premolars, despite the fact that both are much worn. They conform in this respect to the Sinanthropus canines (see *b*) so far as male individuals are concerned. The pattern of the Pithecanthropus canine resembles that of Sinanthropus, but is less complicated by lacking the cingulum so characteristic of the latter. These differences are also true for the premolars and molars, in so far as no one of these teeth in Pithecanthropus shows such primitive characteristics as are found in Sinanthropus. Pithecanthropus, therefore, undoubtedly stands in this respect at the upper limit of the range of variation approaching the Neanderthal types. On the other hand, in respect to other features, Pithecanthropus is of a more primitive nature than Sinanthropus: for example, the second molar of both upper and lower jaw of Pithecanthropus is distinctly larger than the first, and the third lower molar the longest of all three. In addition, it is evident that—the first example of a fossil Hominid known hitherto—the upper canines of both sides are separated from the lateral incisors by a broad diastema, the width of which amounts to 6·2 mm. on the right side (*d*, in reproductions *a* and *c*). This width comes close to the average width known for male gorillas and corresponds to that of the male orang (average width, according to Remane, 6·8 mm. and 6·2 mm. respectively).

The dental arch of the Pithecanthropus upper jaw is long and relatively narrow. The front teeth, according to the alveoli, were ranged within a curved line and directed forward, whereas the molars form two straight and backwardly diverging rows. Thus, all the skeletal remains and teeth of Pithecanthropus and Sinanthropus so far available prove the close general relationship between the two types.

With respect to the affinity of the Pithecanthropus femora—that is to say, the so-called Trinil femur, and the five femora afterwards recovered by Dubois and also attributed to Pithecanthropus—it must be taken into consideration that the seven femora of Sinanthropus, most of them represented only by shafts, show significant differences when compared with those femora. All of the Sinanthropus femora display, among other characteristics, a marked degree of platymeria, and at the same time a very low pilaster index; while the supposed Pithecanthropus femora show no indication of this kind, and are in all respects identical with those of modern man. All this points against the probability of their belonging to Pithecanthropus.

Pithecanthropus and Sinanthropus undoubtedly represent the most primitive Hominid forms known hitherto, which, according to Boule, may be ranged collectively under the name Prehominids. Which of the two types must be taken as the more primitive cannot be decided with absolute certainty for the present. Fragments of Sinanthropus skulls suggest that this type includes also specimens the capacities of which did not exceed that of Pithecanthropus II—as, for example, Sinanthropus skull J—and, on the other hand, those with a very long and rather low cranium, as the Sinanthropus skull fragment H III. Nevertheless, it is certain that Pithecanthropus shows some significant characteristics which must be considered more primitive than those evident in Sinanthropus, especially the presence of a diastema in the upper jaw.

Considered from the general point of view of human evolution, Pithecanthropus and Sinanthropus, the two representatives of the Prehominid stage, are related to each other in the same way as two different races of present mankind, which may also display certain variations in the degree of their advancement.

The Prehominids are separated from the Neanderthal group by a considerable gap. On the other hand, an apparently close relationship exists between Pithecanthropus and *Homo soloensis*, the skulls of the latter appearing like an enlarged form of the former. Certain peculiarities of Pithecanthropus reappear in exactly the same form in *Homo soloensis*. Those traits which suggest an already more advanced type, like the

greater cranial capacity, and several other structural features, can be derived directly from Pithecanthropus, and correspond to the condition in the Neanderthal stage already attained by *Homo soloensis*. The two available fragments of the tibia of *Homo soloensis* show no special peculiarities, with the exception of a pronounced platymeria, exhibiting only recent human characters in their general form and in details.

The finds reported herein show that Java has become the most important centre for the study of Prehominid forms. Not only Prehominids, but also the following evolutionary stage, *Homo soloensis*, are represented there. Furthermore, we know that the Wadjak man of Java represents another early form of recent man, whose upper jaw (Wadjak II) displays in some respects a most surprising resemblance to the Pithecanthropus upper jaw.

In conclusion, we wish to express our gratitude to the officers of the Government of the Netherlands East Indies, and the Carnegie Institution in Washington for their generous support, which made possible not only the more recent investigations in Java itself, but also our joint study, conducted in the Cenozoic Research Laboratory, Peiping Union Medical College, Peking, of recently obtained Pithecanthropus material.

A NATIONAL ATLAS OF BRITAIN

By Prof. E. G. R. Taylor, Birkbeck College, London

PROPOSALS for a National Atlas of Great Britain and Northern Ireland were first put forward from Section E (Geography) of the British Association at the Cambridge meeting in 1938. They met with a warm response from several other sections, with the result that a representative committee got to work and was able to present a preliminary plan for the Atlas in the form of a report to the Association at its Dundee meeting, which has been already noticed in NATURE*. Just before the break-up of the meeting, a joint discussion of the report by interested sections took place, and it is here proposed to outline the ideas concerning the Atlas which emerged during this discussion. As will presently appear, many problems still await solution, but these can fruitfully be examined during the period in which more active steps must wait upon the national emergency.

Put in the briefest possible terms, a National Atlas aims at the cartographical representation of the physical circumstances of the national territory (such as surface configuration, structure, hydrology, mineral deposits, animal life and plant cover), side by side with the circumstances of human occupancy (such as land use, fisheries, mining and industrial enterprises, lines of communication, distribution of population, of occupations, of boundaries, of amenities). Neither physical nor human phenomena are static, and many present-day distributions bear the imprint of the past. Hence the plan necessarily embraces a certain number of historical maps, and even pre-historical, such, for example, as the map of Roman Britain, and the map of Pleistocene Glaciation.

* NATURE, 144, 702 (1939).

While the term 'National' as used in the title carries in the first instance the obvious meaning that the maps are limited to national territory, it possesses also a secondary but very important significance. A National Atlas, if it is to justify publication, must be national in its appeal and in its use. The selection of material and the choice of cartographical technique must be made with the intelligent citizen as well as the scientific investigator in mind. This does not imply a so-called 'popular' style of presentation, for fortunately the last twenty-five years have seen a great advance in the general appreciation of maps. At one time only the gazetteer type, limited to the expression of location, was understood. To this was later added the map showing local conditions: the topographical map, or the daily weather map. More recently still, as may be observed from the appearance of examples in the daily press, distribution maps, usually statistically based and limited to a single phenomenon, have become acceptable; such, for example, are maps of agricultural output, of population density, or of ethnic elements. In brief, the language of the map has become a familiar one.

It is well to remark, however, that Government departments lag far behind the general public in this respect. The enormous volumes of statistics which they collect are rarely, if ever, illuminated by being plotted in map form. Indeed, they are often summarized and tabulated in ways that obscure geographical facts of great significance. It is, in fact, true of statisticians and economists as a body that, up to the present, they have neglected or even rejected the use of maps, and it will be very regrettable if their co-operation is

not secured in the proposed Atlas. The contention that the map can show nothing that the column of figures does not already reveal is easily refuted, although it may readily be admitted that the measure of interpretation and interpolation involved in drawing a map results in a loss of rigid mathematical accuracy. The subjective element is, however, being steadily reduced as cartographic technique advances, and all scientific workers who make customary use of distribution maps are aware that these can prove richly suggestive of new lines of investigation. Among such workers the economic historians appear as recent recruits, and the maps compiled from the statistical records of Domesday Book will provide not the least striking plate in the National Atlas.

It will be a very real gain and a very real economy to find within the pages of a single folio or pair of folio volumes the results of work in widely different fields, geological, meteorological, ecological, economic, and so on, uniformly displayed in such a way as to assist comparative study. Facts that must be sought in a score of publications, maps that, if they exist at all, are drawn on every possible projection and scale, will here be made immediately accessible, and such an Atlas, besides providing an instrument of research, will also serve as an indispensable work of reference, affording material information to the industrialist, to the social worker, to the administrator, to the regional planning authority, to the man of affairs.

The usefulness of the National Atlas will not, indeed, be called in question. Doubts may arise as to whether the material is available for so comprehensive and so complex a publication. In fact a very great body of material, very diverse in character, already exists in map form, and only awaits transference to uniform base maps. A further great body exists in statistical shape, and its actual mapping demands no more than the services of a trained cartographer. There remain, however, a number of desirable maps which must be the subject of research: a lithological map, for example, a water supply map, a smoke pollution map, maps of accessibility of individual towns by road and rail. Yet others depend upon data that are only very slowly accumulating: a map of the distribution of soils, for example, or, in quite another field, a map of the distribution of place names, which throw so clear a light on early settlement. Many such maps, if they can be drawn at all, must be partial and tentative, and in an Atlas intended for general as well as for specialist use, they will demand very careful cartographical treatment if they are to be free from *suggestio falsi*.

Of quite another character is the difficulty arising from the territorial division of the island of Ireland into two separate political units of which only one is part of the national territory of Britain. The unit of area for topographical, climatological, and many biological maps is obviously the British Isles, but official statistics, and certain official maps (those of the Ordnance Survey, for example), stop short at the boundary of Northern Ireland. It is too early to say whether some form of co-operation with Eire may not eventually be achieved.

In very many cases, of course, separate maps of England and Wales as one unit, and of Scotland and Northern Ireland as another, will be appropriate, and the basic scale of one to a million ($1/M$), involving a page size of approximately 21 in. × 14 in., has been chosen with this point in view. The use of an identical base map, suitably enlarged or reduced in scale, for every map in the Atlas, intended to facilitate rapid and exact comparisons between one distribution and another, is a cardinal feature of the plan.

It will be abundantly clear that only by willing co-operation among scientific workers whose material lends itself to cartographic exposition can a worthy National Atlas be eventually achieved. Pending the reorganization of the Atlas Committee, which it is hoped will not be long delayed, the present writer will be happy to act as a clearing house for suggestions and ideas.

OBITUARIES

Prof. R. A. Sampson, F.R.S.

WE regret to record the death of Prof. Ralph Allen Sampson, Astronomer Royal for Scotland and professor of astronomy in the University of Edinburgh during 1910–37, which took place at Bath on November 7.

Sampson was born in County Cork in 1866. From the Liverpool Institute he entered St. John's College, Cambridge, graduating in 1888 as third wrangler. Two years later he was awarded a Smith's Prize, and a fellowship of his College followed immediately. Between 1889 and 1891 he was a lecturer in mathematics at King's College, London, returning in the latter year to Cambridge as the first holder of the newly-endowed Isaac Newton studentship. In 1893 he went to Newcastle-on-Tyne as professor of mathematics in the Durham College of Science, and two years later he succeeded to the chair of mathematics in the University of Durham, which became in 1908—a restoration after some years of abeyance

—the chair of mathematics and astronomy. In 1910 Sampson migrated still farther north, succeeding Sir Frank Dyson, on the latter's transference to Greenwich, as Astronomer Royal for Scotland and professor of astronomy in the University of Edinburgh.

Sampson's greatest work was his theory of the four great satellites of Jupiter. This immense undertaking, which involved the discussion of thousands of eclipses of the satellites and demanded qualities of perseverance and patience in addition to mathematical powers of the highest order, engrossed his attention for more than a quarter of a century. The observational material he used fell into two categories: (1) old observations made visually, and (2) the photometric observations of the gradual disappearances of the satellites in eclipse, made at Harvard between 1878 and 1903. Although the general mathematical theory did not appear until 1921 (*Mem. Roy. Astr. Soc.*, **63**) the University of Durham undertook in 1910 the publication of the "Tables of the Four Great Satellites of Jupiter", and in the previous year Sampson's discussion of the photometric observations appeared in vol. 52 of the *Harvard Annals*. For these researches he was awarded in 1928 the Gold Medal of the Royal Astronomical Society.

Sampson's first research (1894) was on the "Rotation and Mechanical State of the Sun". At an early stage he became convinced that a satisfactory theory of the distribution of temperature in the interior of the sun was essential to his purpose. He discarded the principles of convective equilibrium and attempted a discussion of temperature conditions by means of simple hypotheses governing radiation and absorption—twenty years before the foundations of atomic physics were laid. In this work Sampson was a true pioneer. In 1900, he edited J. C. Adams's "Lectures on the Lunar Theory" and, later, the Adams manuscripts relating to the discovery of Neptune.

Sampson's most valuable contribution to astronomy during his directorship of the Royal Observatory in Edinburgh was his work on measuring the effective temperatures of the stars. During this period, too, he was greatly interested in the performance of clocks and he contributed many papers on this subject to the Royal Society of Edinburgh.

Sampson was elected to the Royal Society in 1903. From 1915 until 1917 he waspresident of the Royal Astronomical Society and for many years he acted as secretary of the Royal Society of Edinburgh. He held the honorary degrees of Sc.D. and LL.D. of Durham and Glasgow respectively, and in 1921 he was elected a corresponding member of the Bureau des Longitudes (Paris). He is survived by his wife, one son and four daughters. W. M. SMART.

Prof. R. V. Wheeler

RICHARD VERNON WHEELER, director of the Safety in Mines Research Stations, professor of fuel technology in the University of Sheffield and editor of *Fuel in Science and Practice*, died at his home in Sheffield on October 28 at the age of fifty-six years. He graduated in the University of Manchester in 1903, where as an undergraduate he had already joined the band of research workers who laid the foundations of our present knowledge of flame and combustion, the famous Manchester school which will always be associated with the names of H. B. Dixon, W. A. Bone and R. V. Wheeler.

Wheeler became one of the leading authorities on safety in mines both in Great Britain and abroad, being awarded the Gold Medal of the Institution of Mining Engineers in 1937, and also one of the leading fuel technologists, receiving the Melchett Medal of the Institute of Fuel in 1938, but he always remained at heart a research worker. Having little use for the *ad hoc* and empirical type of research, he was fortunate in having the ability to convince those responsible for the organization and financing of the researches over which he had control of the importance and value of long-range and fundamental research. This ability was largely due to the clarity with which he explained complex problems to the non-scientific or non-technical man. As a result he was enabled to build up teams of research workers who have carried out extensive investigations in each of the fields of work in which he was interested.

In dealing with some of the most important problems involved in the winning and utilization of coal, namely, dust explosions, spontaneous combustion, carbonization and industrial burning, Prof. Wheeler regarded a knowledge of the constitution of coal as being of prime importance. This was emphasized in the "Monograph on the Constitution of Coal" written by him and Dr. M. C. Stopes and published by the Department of Scientific and Industrial Research in 1918. In this publication, which greatly stimulated research in this field, they summarized critically the work already done, and surveyed the ground to be covered by future workers. Wheeler took a prominent part in the development of this work with the assistance of many collaborators, and the main results are to be found in a series of twenty-five papers in the *Journal of the Chemical Society* under the general heading of "Studies in the Composition of Coal". The application of these researches to the more technical problems was well brought out in a series of papers published in the technical press. In his work on the prevention of gaseous explosions he emphasized similarly the importance of a fundamental knowledge of the mode of ignition and combustion of gaseous mixtures. The outstanding work in this direction was published in papers in the *Journal of the Chemical Society* dealing with the ignition of gases and with the uniform movement during the propagation of flame. The justification of his long-sighted policy is again shown by the important series of papers in the technical press showing how this knowledge could be applied.

Despite the wide range of the subjects of these researches, Prof. Wheeler always took keen interest in every piece of research under his direction, large or small, and was a continual source of suggestions and advice. He was an extremely hard worker, his enthusiasm for his work was infectious and he earned the esteem and respect of all those fortunate enough to work under him.

No account of Prof. Wheeler would be complete without reference to the respect and affection felt for him by the mining community, men as well as masters, to whom his name was a household word. His staff at the Buxton Research Station of the Safety in Mines Research Board treasure the tributes paid to him by colliers visiting the Sunday 'demonstrations', referring to him, for example, as "the greatest friend of the miner since Sir Humphry Davy".

W. PAYMAN.

Vice-Admiral Sir Percy Douglas, K.C.B., C.M.G.

VICE-ADMIRAL SIR PERCY DOUGLAS, who died on November 4 at the age of sixty-three years, joined the surveying branch of the Royal Navy in 1898 and at once showed marked aptitude for this type of work. He possessed an alert brain and was more than a little interested in 'gadgets'; anything which could relieve the labours of the surveyor in the field was of particular interest to him, and being of an inventive turn of mind, he did a great deal to lighten their work and expedite production.

Whilst in command of H.M.S. *Waterwitch* on the China Station and in collaboration with the late Commander J. Sharpey-Schafer, Douglas introduced the Douglas-Schafer sounding gear, which was a great advance on former methods of sounding in comparatively shallow water; later he was responsible for the Douglas protractor and, jointly with Prof. R. Appleyard, perfected the arcless sextant. During the War of 1914–18, Sir Percy was appointed to serve as hydrographic surveyor on the staff of the Vice-Admiral, Aegean, and at a later stage in the same capacity with the Flag Officer at Dover; between these two appointments he was the first director of the Naval Meteorological Service.

His knowledge of hydrography and geodesy was of the greatest assistance in the Dardanelles campaign, and also in the attacks on the Belgian coast, where indirect fire and bombardment was of such importance and where sound-ranging was developed to meet the need for the accurate bombardment of enemy gun positions.

After the War, Admiral Douglas interested himself in the development of echo sounding apparatus, and it was largely due to his initiative that the Admiralty echo sounding gear was perfected and brought into use. In addition to his official duties as hydrographer of the Navy, Sir Percy was, during his term of office, an *ex officio* member of the National Committee for Geodesy and Geophysics of the Royal Society, and served on the Council of the Royal Geographical Society.

Sir Percy became a member of the "Discovery" Committee in 1925 and his wide experience and knowledge were of immense benefit to this body. Shortly after his retirement he was appointed by the Board of Trade to be acting conservator of the Mersey and somewhat later became chairman of the Dover Harbour Board.

Sir Percy was a fellow of the Royal Astronomical Society and of the Royal Geographical Society and a Younger Brother of Trinity House. At the time of his death he was serving as Commodore Superintendent of the Dockyard at Dover.

J. A. EDGELL.

Dr. T. L. Prankerd

IT is with deep regret that we record the tragic death in a street accident, on November 11, of Dr. T. L. Prankerd, for many years lecturer in botany in the University of Reading.

Theodora L. Prankerd was born in 1878 at Highgate, the daughter of Dr. O. R. Prankerd. She was educated at Brighton High School and the Royal Holloway College whence she graduated in science at the University of London. Later she was appointed to the staff of Bedford College (University of London) and then proceeded to carry out her early botanical researches at the University of Chicago. In 1917 she was appointed lecturer in botany in University College, Reading, where she remained until the College received its Royal Charter in 1926, and then she continued as lecturer in the University up to the time of her death. She was admitted fellow of the Linnean Society in 1919.

Dr. Prankerd's botanical researches were characterized by unlimited patience and exactitude. Her earlier work was morphological. In her first paper on the water violet, Hottonia, interest centres in pure anatomy and possible phylogeny; and this comes out more strongly in her next paper on a coal ball seed of which she gave a very careful description. Although her interest remained largely morphological, her other published papers are concerned with the perception of the stimulus of gravity by organs, and reveal a great number of patient experiments. She ardently supported the theory of statolith perception, and although many consider that this conflicts with the hormone theory, she herself was trying to combine the two into a comprehensive theory of perception and transmission.

But it will not be as a research worker so much as a teacher and friend that Dr. Prankerd will be remembered. Hosts of students have passed through her hands. Nothing was too much trouble for her, and many a student will recall with gratitude the kindly help which she always offered; and this was not confined solely to study. She took a personal interest in her students.

Dr. Prankerd had a keen sense of justice and would stop at nothing in her efforts to make justice prevail whether for an ideal or an individual. For that reason she was sometimes judged harshly by others though never by anyone who was prepared to probe beneath that veneer of seeming forcefulness, for then they found a kindly and sympathetic woman. He or she who finally gained her friendship soon realized how intensely loyal she was. She was a woman, too, of great breadth of vision and high ideals. Thus, her life was not devoted solely to her plants. She was a great advocate of peace, and her efforts for the League of Nations Union were tireless.

She was also an artist of no mean calibre. She had many delightful water-colour sketches to her credit. Her literary tastes were often reflected in her lectures, which, though not always easy to follow, were a delight to hear.

Hers was such a personality that she will be remembered affectionately by many of her former students when some of their more brilliantly scientific and successful teachers have been forgotten. It is an irony of fate that a woman who argued and worked for peace so unflinchingly should have met her death on Armistice Day.

Dr. Prankerd leaves her mother to whom she was devoted and to whom our deepest sympathies are extended.

WE regret to announce the following deaths:

Prof. F. Angell, emeritus professor of psychology in Stanford University, on November 2, aged eighty-two years.

Prof. Charles Barrois, formerly professor of geology in the University of Lille, on November 8.

Mr. C. J. Bond, C.M.G., a former member of the Industrial Health Research and of the Medical Research Board, on November 23, aged eighty-three years.

Mr. Wilfred Trotter, F.R.S., sergeant surgeon to H.M. the King, and consulting surgeon at University College Hospital, on November 25, aged sixty-seven years.

NEWS AND VIEWS

Pithecanthropus and Peking Man: Comparative Studies

BY a happy and fruitful conjunction in comparative study of old and new material, Dr. G. H. R. Koenigswald, of Bandoeng, Java, and Prof. Franz Weidenreich of the Peking Cenozoic Research Laboratory, are able to record in another column of this issue of NATURE (see p. 926) some remarkable observations bearing on the relationship between those early fossil hominids, or precursors of man, Pithecanthropus of Java and Peking man. In the further light now thrown upon the problem of the descent of man by recent discoveries of both Sinanthropus and Pithecanthropus—of the former, some still undescribed, of the latter, some of the more important made only in the current year in response to intensified search—the authors demonstrate by detailed comparison not only the essentially human affinities of Pithecanthropus, which Dubois, its first discoverer, has come to question, but also the very close affinity of Pithecanthropus to Sinanthropus, of whose right to stand in the line of human descent no doubt has ever been raised. Further, among the latest Pithecanthropus material to be discovered is an upper jaw, which in the separation of canines from incisors presents a character hitherto regarded as distinctively Simian. The appearance of this character in Pithecanthropus is notable as it has been adduced as an argument in discussion of the Piltdown jaw. By far the most interesting and significant result to emerge is, however, not so much the affinities of the two groups of fossil remains as their differences, in which not only now one now the other exhibits an approach to modern man, but these differences also indicate that the variability, which is so marked a feature in the individual specimens of Sinanthropus, is almost equally striking when the two groups are compared each as a whole. In other words, there is evidence even at this comparatively early stage of human evolution of a variation which may be termed racial. Of the authors' pregnant allusions to the position of *Homo soloensis*, no more need be said here than to express a confident hope of further light from an equally fruitful collaboration.

Anthropometry and the War

IN a written reply in the House of Commons under date September 28, to a question in reference to offers from ex-officer anthropologists to conduct an anthropometric survey of H.M. Forces, Sir Victor Warrender, financial secretary, War Office, stated that he was advised that "though such a survey might be of scientific interest, it is impossible in present circumstances to carry it out, owing to the time which would be required for the purpose". Captain A. G. Pape, by whom the attention of NATURE has been directed to the passage in *Hansard* reporting question and author (September 28, 1939, p. 1516), writes strongly urging the need and advantages of such a survey, which, he informs us, he himself had suggested to the authorities with the offer of his services. Readers of NATURE will scarcely need to be reminded of the deplorable gap in evidence relating to the constitution of the British population, owing to the lack of systematic records of physical characters and other anthropometric data. The survey contemplated by Captain Pape, however, is apparently of a far more extensive character, and would include observations demanding the services of medical and psychological specialists, and an extension to the rising generation through an organization embracing both university and school. Strong though the argument for an anthropometric record of the population may be—the need will be much more insistent when post-war measures of social amelioration have to be considered—it is probably quite inevitable that in so far as regards H.M. Forces, the time factor is all-decisive. While opportunity might possibly be found to examine troops serving in the field or in training, these subjects would not be representative of an average sample of the popula-

tion; and the measurement and recording of the minimum observations of any value of men as they are brought up for enrolment in the Forces, who would more nearly approach the standard of the general population, would overburden the medical officer, who already protests against the inadequate time allowed for individual examination owing to pressure of numbers.

The Settlement of Europe

THE admirable broadsheet "European Order and World Order" issued by Political and Economic Planning (P E P), a summary of which appears on p. 948 of this issue, should go far to clarify the confusion which has resulted from the use in current discussions of such terms as 'war aims' and 'peace aims'. The terms on which the belligerent powers will make peace can scarcely be usefully discussed until the outcome of the war is known. On the other hand, neutrals as well as belligerents will have to consider far-reaching measures for reconstruction and for establishing a new international order. This post-war question of reconstruction requires immediate discussion and study if a settlement which is both technically possible and politically acceptable is to be found. No international conference can be expected to do more than put into final form and ratify measures which have already been worked out by experts and approved by the political advisers of all the countries concerned. Moreover, it is neither necessary nor desirable that the reconstruction problem should be tackled simultaneously with that of establishing peace. Indeed the former is visualized usually as a long-term problem for which appropriate machinery must be kept in being over a term of years rather than weeks. The fact that P E P has thought it worth while to issue a broadsheet upon these problems indicates that they are already receiving serious, if unofficial, attention. It is at least encouraging that so many new minds are being brought to bear upon them and so many new ideas are being sifted and taking shape. The scientific and constructive approach outlined by Political and Economic Planning claims the closest attention by scientific workers, and may well help them to see in what direction their own contribution can most effectively be made.

Association of Scientific Workers

THE annual council meeting of the Association of Scientific Workers was held in London on November 25. In the report submitted by the Executive Committee, the activities of the Association during the past year were reviewed. These included general activities before the War, such as the Legal Committee and the Scientific Films Committee, and special activities since war broke out, which included the collection of information on the effect of the War on science and scientific workers. The Executive Committee had drawn up a tentative scheme for the setting up of a State Department for the Co-ordination of Science and had submitted this scheme to a number of scientific bodies for their comment; these bodies had in general replied that they could not work in this way to improve the status of science. A net increase in membership of 25 per cent during the last year was also reported. The president of the Association, Prof. F. G. Donnan, in his address to the meeting, stressed the necessity of building up activities that would have an economic appeal to potential members of the Association, and suggested the possibility of establishing an unemployment benefit fund. The Association, in trying to represent men of science of all subjects in one body, has a great task before it, and in view of the existence of many sectional organizations for men of science, it must offer strong inducements to gain members.

THE general feeling of the membership that the Association should do a great deal more in the day-to-day economic interests of the scientific workers, particularly those in industry, was expressed in the unanimous adoption of a resolution: "That steps be taken to ensure that the primary purpose of the Association is to effect the organisation of scientists, since any satisfactory co-ordination of science depends upon an adequate organisation of scientists". The deep concern felt by members of the Association at the rapidly increasing disorganization in scientific work throughout Great Britain was expressed in the discussion of two further resolutions, and while it was carried by a majority vote that the Association should not press for a Ministry of Science in the present circumstances, the Executive Committee was instructed to press for the establishment of a national council consisting of representative scientific and technical personnel, which would have the object of achieving adequate organization and full use of the scientific resources of the country. The following officers were elected for the year 1939–40: *President*, Prof. F. G. Donnan; *New Vice-Presidents*, Prof. P. M. S. Blackett, Prof. D. Keilin; *Hon. General Secretary*, Dr. W. A. Wooster; *Hon. Treasurer*, Dr. L. Klatzow.

New International Hormone Standards

IT was stated in NATURE of May 13, 1939, that the Third International Conference on the Standardisation of Hormones, held at Geneva in 1939, had decided that international standards should be established for certain hormones of the anterior lobe of the pituitary gland and analogous substances found in urine and serum, and that international units should be defined in terms of a weight of each such standard. It was further decided that the final preparation of these standards, their dispensing in a form suitable for the use of the laboratory worker, their storage, preservation and subsequent distribution should be undertaken by the National Institute for Medical Research, Hampstead, London. The first of these new standards, as announced earlier in the year, namely, that for the gonadotrophic substance of human urine of pregnancy—chorionic gonadotrophin—was established in May of this year. The preparation of two additional international standards has been completed, namely, for the

gonadotrophic substance of pregnant mares' serum and for the lactogenic (crop-gland stimulating) substance of the anterior lobe of the pituitary gland. The former standard has been prepared from substantial amounts of material generously provided by five manufacturing firms in four different countries, and the latter from material supplied by seven manufacturing firms and two research institutes in five countries. In the case of each standard the individual samples were examined by members of the Conference and a suitable mixture was then made to serve as the respective international standard, and finally dispensed in the form of tablets which have been packed in sealed tubes. In the case of each standard, each tablet contains approximately 100 international units.

THE international standard for the gonadotrophic substance of pregnant mares' serum is dispensed in the form of 25-mgm. tablets, each sealed tube containing ten of the tablets, and the international unit has been defined as the specific gonadotrophic activity contained in 0·25 mgm. of the standard preparation. The international standard for prolactin is dispensed in the form of 10-mgm. tablets, each sealed tube containing ten of the tablets, and the international unit has been defined as the specific activity contained in 0·1 mgm. of the standard preparation. As in the case of the international standards for other hormones, drugs and vitamins, the above international standards are held, on behalf of the Health Organisation of the League of Nations, at the National Institute for Medical Research, Hampstead, London, N.W.3, and are distributed therefrom to national control centres established in other countries for local distribution to laboratories, institutes and research workers, and to workers in other countries in which the establishment of national control centres has not yet been completed. With regard to the supply of these new standards to those requiring them in the United Kingdom, applications should be made to the Department of Biological Standards, National Institute for Medical Research, Hampstead, London, N.W.3.

Standardizing Genetical Symbolism

AT the International Congress of Genetics held at Ithaca, N.Y., in 1932, it was resolved that the genetical societies of all countries be asked to co-operate in preparing recommendations regarding the problem of standardizing genetical symbolism, in order to discuss them at the next International Genetical Congress. Prof. Tine Tammes (Groningen), who was appointed to take charge of this work, produced a preliminary report in conjunction with Dr. H. de Haan and then turned over the task to the International Union of Biological Sciences. This body, together with the International Institute for Intellectual Co-operation at Paris, convoked a meeting of delegates from various countries, which was held in the rooms of the Linnean Society of London on August 14–15, 1939, with Prof. M. J. Sirks (Groningen) as chairman. The delegates were Dr. A. Eastlier and Miss N. Nicolsky (from the I.I.I.C. in Paris), Prof. O. Winge (Denmark), Dr. B. Ephrussi (France), Prof. H. Nachtsheim (Germany), Prof. R. R. Gates, Prof. J. B. S. Haldane and Mr. A. E. Watkins (Great Britain), Prof. K. v. Körösy (Hungary), Dr. K. Ramiah and Dr. S. N. Venkatraman (India), Prof. M. J. Sirks and Dr. S. J. Wellensiek (Holland), Prof. O. L. Mohr (Norway), Prof. M. Skalinska (Poland), Dr. O. Tedin (Sweden), Prof. F. Baltzer, Prof. A. Ernst and Prof. E. Hadorn (Switzerland), and Prof. E. W. Lindstrom (U.S.A.). The delegates from Belgium, Finland, Italy and Japan were unable to attend. A preliminary series of rules for the symbolizing of genes and chromosome aberrations was drawn up at this meeting.

Science and Ethics

IN the *Scientific Monthly* of October, Prof. E. G. Conklin discusses the question: "Does science afford a basis for ethics? The highest level of human development, he urges, is attained when purpose and freedom, joined to social emotions, training and habits, shape behaviour not only for personal but also for social satisfactions. Society, no less than the individual, is seeking satisfactions, and when all these things combine, we have what we call ethics, or the science of right conduct. Science, he considers, affords a sound basis for ethics in spite of the fact that it is regarded as natural rather than supernatural in origin and development. With increasing knowledge of Nature and man, many codes have been shown to be unreasonable and unethical, and science has helped to replace them by more rational and humane ones. Science is knowledge of Nature and of man, and ethics being dependent on such knowledge it is impossible to divorce ethics from science. Science did not create Nature or man or ethics, and cannot be held responsible for their imperfections. It is as absurd to attribute human greed, aggression, hate and war to science as it would be to hold it responsible for hurricanes, earthquakes or pestilences. Because science regards ethics as a natural phenomena, it can hope to determine the causes of unethical behaviour and attempt to improve ethics by controlling these causes.

PROF. CONKLIN thus believes that progress in the control of social disorders should be possible in the same way as in the control of bodily diseases. Science has helped to make war so terrible that sane people everywhere fear and shun it. More indirectly, science can investigate the causes of war and show how they can be removed, for war and social disorders in general can be cured only as bodily diseases are, by controlling their causes. The main hope for human peace and progress lies in the cultivation of habits that make for peace and progress, especially in the leaders of the nations. There can be no final solution of the problems which threaten the very existence of civilization except through the cultivation of a wider and more generous form of ethics. Hope for the future rests in the co-operation of science, education and religion.

Fur-trade in Northern Manchuria

THE predominance in the news of political activities in Manchoukuo tends to obscure the fact that it supports an active Institute of Scientific Research, the latest publication of which describes one of the staple industries of Manchuria, the fur trade (*Rep. Inst. Sci. Res., Manchoukuo*, **3**, 227; July 1939). In a lengthy paper W. N. Schernakow describes very fully, from his own journeys in Manchuria and from the contributions of other writers, various aspects of the extensive fur-trade. The majority of the fur-bearing animals are captured by means of snares, traps, pits, as well as by firearms and poison, but sometimes hunting dogs and birds of prey are employed, and one of the illustrations actually shows a hunter in the Barga using bow and arrow. The furs are collected locally, and ultimately most find their way to the fur-market at Harbin. Here in the season 1937–38, 1,217,169 furs were sold, an increase of more than a quarter million over the sales of the previous year. The greater number represents five relatively common species: Tolai hare (*Lepus tolai*) 500,000; rat (*Rattus norvegicus caraco*) 200,000; Sansing squirrel (*Sciurus vulgaris mantchuricus*) and yellow ermine (*Mustela alpina raddei*) 100,000 each; and kolinsky (*Mustela sibirica* of various subspecies) 130,000. The rare skins represented by ten or fewer individuals at the fur-market were wolverine (*Gulo gulo*) and bear (*Ursus mantchuricus*) 10 each; leopard 5 and Manchurian tiger (*Tigris tigris coreensis*) 4. The author regards the preservation of woodland as the surest way of preserving the fur-bearing animals, and he points out that the Chinese destroy not only woodland but even brush-wood wherever they settle.

Recent Archæological Finds in Staffordshire

A NUMBER of discoveries of interest are recorded in the report of the archæological section of the North Staffordshire Field Club for the period 1938–39 (*Trans. and Ann. Rep. N. Staffs. Field Club*, **73**, 1939). Among these may be mentioned a disk barrow, hitherto unrecorded, which was discovered by G. J. V. Bemrose, chairman of the section, on a hill slope overlooking the stream at Oakley. Further examination, in the course of which several well-patinated flints were found on the surface, confirmed the view that it was of the central monolith type, the site of the monolith being clearly discernible. The proximity of the Devil's Ring and Finger is considered significant, while it is pointed out that it is probable that Oakley Park drive is the site of a Romano-British road linking Chesterton (Mediolanum) with Rutunium and Uriconium. Further evidence of a Romano-British road comes from Madeley Old Manor Park, where a half-mile stretch of a 'way' has been identified. It forms part of a way, on which on a length known as Longford, between Wellington and Newport, an air photograph has shown a Roman 'castra' near Wall, superimposed on a British hill-fort and other earthworks, hitherto unknown. A Romano-British residence site at Park Springs, of which the excavation was begun by W. L. Hind in 1927, now shows that the corridor and rooms were paved with hard fired tiles, measuring 5 inches square by 1 inch thick. They had been surfaced by red slip before firing. The walls were plastered and decorated in fast colour-wash, which is still bright after sixteen centuries in damp, loamy soil. One room was decorated in various shades of green and yellow. Evidence points to more than one period of occupation.

Hot Spraying of Shellac

THE high viscosity of whole shellac when liquefied, and the difficulty of maintaining it fluid for any considerable length of time, were responsible for the failure of the original experiments to melt and spray it under steam pressure. We have received from the London Shellac Research Bureau, India House, Aldwych, London, W.C.2, a pamphlet describing the work done by K. E. Lalkaka in the laboratory of chemical engineering of University College, London, on behalf of the Indian Lac Cess Committee and under the supervision of Prof. H. E. Watson. The later experiments described were directed towards using pulverized shellac and causing the powder to fuse by passage through a flame, the fused particles being projected upon a surface to form a well-bonded coat. The various means tried for securing a steady supply of the pulverized material to the flame are described and also the development of a simple apparatus for carrying out the process effectively. A study has been made of the operating conditions.

MATERIALS used in protective and decorative coatings are generally used in solution or emulsion forms applied by brush, spray or pad. It is found that a small amount of the solvent is invariably retained by the film even after prolonged drying. This residual solvent is responsible for the poor water resistance and the comparatively short life of the protective coat. In particular, shellac varnish gives films which 'blush' when immersed in water, but a flake of shellac remains clear and unaffected even after several months of immersion. The technique of a new method is described and the following surfaces have been satisfactorily treated by the process: wood, paper; tin, aluminium and copper sheet; concrete, glass, asbestos board, plaster castings and porous stoneware. The results are published for the information of all interested in this novel field of application of shellac.

Electricity on Board Ship

THE Institution of Electrical Engineers has just published the third edition (September 1932) of the "Regulations for the Electrical Equipment of Ships" (3*s*. 3*d*., cloth; and 2*s*. 2*d*., paper. E. F. and N. Spon, or the Institution of Electrical Engineers). These regulations enumerate the main requirements and precautions for ensuring safety from fire and shock, in connexion with the generation, storage and distribution of electrical energy for all purposes in sea-going ships of all descriptions with the exception of warships. The book will be essential to manufacturers, navigators, and marine architects, and will

be useful to all who travel by sea. It begins by giving definitions indicating the sense in which the various technical expressions given are used throughout. An 'earth', for example, is a connexion to the general mass of the hull of a steel ship, and detailed definitions are given of words like watertight, weatherproof, etc., so that the exact meaning of these words when they appear in marine contracts can be found.

FOR direct current, the standard voltages are 110 and 220, but for small vessels, like tugs, trawlers, small yachts, fishing and similar small vessels, the standard voltages are 12, 24 and 110. The regulations are fairly stringent; for example, every sea-going ship in which electric power is used for essential services shall, except where other means are available for maintaining these services, be provided with two or more generating sets of such combined output that in the event of one set being disabled the remaining generating plant shall be capable of supplying the essential services. Where electric discharge lamps or luminous discharge tubes are used, lighting by one or more incandescent filament lamps shall be provided as necessary to ensure safety in the event of the extinction of the discharge lamps. It must also be arranged that electric discharge lamps should operate satisfactorily with the ship inclined to the normal at any angle up to 15° transversely and 10° longitudinally, and with rolling up to 22½° with the vertical. We also learn that lightning conductors need not be fitted to steel ships having steel masts. Appendix 3 is very important, as the suppression of electrical interference with radio apparatus is clearly discussed. A list of devices and apparatus is given in regulation 413, which it is recommended should never be less than ten feet distant from any magnetic compass.

Mining Electrical Engineers

AT the first meeting this season of the South Wales Branch of the Association of Mining Electrical Engineers, held at Cardiff last month, the new branch president, Mr. D. J. Thomas, gave his inaugural address. He referred to the position of the colliery electrician, who is surrounded with regulations and restrictions, with equipment under his care on which many lives may depend, unless frequently inspected, and yet he has little authority and practically no status. The equipment also with which he is provided has often passed its useful life, while much of the new equipment supplied is unsuitable for the class of work to which it is put. The apparatus has to withstand rough usage, and Mr. Thomas believes that there is insufficient appreciation on the manufacturers' part that there are conditions other than purely electrical ones that have to be considered. The increasing amount of machine mining performed electrically and the wholesale electrification of surface and underground equipment make the modern colliery absolutely dependent upon electricity, and the mining electrical engineer holds a position of very great responsibility. It is of vital importance that this should be recognized.

British Museum (Natural History): Acquisitions

A GIFT has been made to the Department of Mineralogy of a large polished slab of thodonite and pyrolusite, both manganese minerals, from Pencrebar, Callington, Cornwall, collected by the donor, Mr. Arthur Russell, president of the Mineralogical Society. A well-crystallized stilbite from Kalumpang, Ulu Selangar, has been presented by the Director of the Geological Survey of the Federated Malay States. This is the first zeolite specimen from that locality to be added to the British Museum collections. Three interesting specimens of Terra Sigillata have been presented by Mr. E. P. Bottley. Similar tablets of clay, formerly included in every pharmacopœia as an antidote for snake bites and poisons, were shaped and stamped from medicinal earth found in various localities, notably the Island of Lemnos, Greece, and Prussian Silesia. These three tablets are probably eighteenth century specimens and bear easily legible insignia and characters. They form a welcome addition to a very fine set belonging to the Sloane collection. Terra Sigillata clays and related materials, such as China clay, have very high absorptive properties which render them of value in the treatment of dysentery and cholera.

Negro Education in the United States

AMERICAN Negroes have seldom played any notable part in education. A well-documented paper book, "Special Problems of Negro Education" (Washington, D.C.: G.P.O. 25 cents), shows that coloured children suffer from an inequality of chances compared with whites. The author, Prof. Wilkerson, has made several studies of the subject, and the results are gathered in this monograph. Negroes are required by law to attend separate schools in eighteen States, from Alabama to West Virginia. Four fifths of them are in the South and supply nearly one fourth of the population. Is their education in separate schools adequate, and, if not, what can be done to improve it? These are the questions the author answers. The figures tabulated are a little puzzling, but suggest on careful examination that during 1933–34 school attendance was considerably less among Negroes than whites. The Negro schools were kept open on the whole for a shorter time, though States offer varying data. A racial difference of one school month becomes over a period of years a real handicap and leads to lower levels of scholastic achievement; pupils retarded in early grades are likely to drop out of school. Eminent authorities all agree that they are quite as good in learning ability as whites. Transportation for education is important for rural districts, and here, too, they are handicapped, while they have fewer and worse-paid teachers. These disparities have been defended, but no sensible authority doubts that they should be eliminated. In Mississippi many of the coloured schools are housed in churches, old stores and shanties and lack decent comfort and educational materials. The story of higher education is similar, but it has to be noted that the Southern States in view are unable to finance public education at a satisfactory level. A much enlarged programme

of Federal aid is needed, and a recent decision of the United States Supreme Court recognizes the right of Negroes to "proper provision" of graduate and professional study. So the States must provide separate facilities for them, or admit them to their universities.

Amendments to the Therapeutic Substances Act

THE Joint Committee which administers the Therapeutic Substances Act, 1925, has issued some amending regulations (Statutory Rules and Orders, 1939, No. 1395. H.M. Stationery Office. 2*d*. net). A new regulation requires that every holder of a licence to manufacture therapeutic substances, who engages in the culture or manipulation of pathogenic spore-bearing micro-organisms, shall provide separate laboratories, utensils and apparatus required for the culture or manipulation of such micro-organisms. New regulations are also imposed respecting the labelling, testing and standardization of tetanus toxoid and gas gangrene antitoxin.

Earthquake in Turkey

FOR the second time recently Turkey has been stricken by a disastrous earthquake. On September 22, the epicentre was near Smyrna (NATURE, September 30, p. 589). Now, on the morning of November 23, an intense shock destroyed at least six villages in Anatolia. Eighteen people are known to have been killed, but complete news is not yet available since telegraphic and other communications were interrupted by the earthquake.

The Night Sky in December

ON December 22 at 18h. the sun enters the sign Capricornus (the winter solstice). In the latitude of London, the night then lasts for 16¼ hours. The moon is new on December 10 and full on December 26. Lunar conjunctions with the planets occur as follows: on December 9d. 10h. with Mercury; 13d. 1h. with Venus; 18d. 10h. with Mars; 19d. 8h. with Jupiter; and on 21d. 8h. with Saturn. The geocentric distance between moon and Mercury at conjunction on December 9 is only 0·2°. Mars, Jupiter and Saturn south at about 17½h., 18½h. and 20h. respectively in mid-December and are therefore well placed for observation in the evening sky. Venus is also coming into visibility as an evening star and may be seen low in the south-west after sunset. Mercury is at greatest elongation (21° W.) on December 17, and it may then be seen low down in the south-east before sunrise. In the late evenings of this month, there is a fine array of stars between the eastern horizon and the meridian. The variable star, Algol (β Persei), souths at about 21½h. in mid-December. Its change of light is most easily noticeable about 1½ hours before and after the following epochs: December 4d. 4·8h.; 7d. 1·7h.; 9d. 22·5h.; 12d. 19·3h.; 15d. 16·1h.; 27d. 3·4h. and 30d. 0·2h. To the east of Algol, spread over an area of about 2° in diameter, is a cluster of about five hundred remote stellar systems. A member of another cluster in Gemini, for which a spectrogram was secured at the Mt. Wilson Observatory, shows a redward shift of the spectral lines equivalent to a speed of recession from the solar system of more than 14,000 miles per second and indicating a distance of 135 million light years. The Geminid meteors, with their greatest frequency about December 10–12, have a radiant point a few degrees preceding Castor. At midnight on December 31, the brightest star, Sirius (mag. −1·6), is 4½ min. before the southern meridian.

Announcements

IN view of the delay likely to be caused by postal difficulties in the present circumstances, writers of "Letters" submitted for publication in the correspondence columns are advised that, in general, proofs of communications will not be sent to authors outside Great Britain.

DR. GERHARD DOMAGK, who was recently awarded the Nobel Prize for Physiology and Medicine for 1939, has been elected an honorary member of the Pharmaceutical Association of the Hindu University of Benares.

DR. JUAN JACOBO SPANGENBERG has been nominated president of the National Department of Health of the Argentine Republic in succession to Dr. Miguel Sussieri, who has retired.

THE King has been pleased to grant Dr. Herbert Chatley his authority to wear the insignia of the Order of the Brilliant Jade conferred upon him by the President of the National Government of the Republic of China, in recognition of valuable services rendered by him as engineer-in-chief of the Whangpoo Conservancy Board.

PROF. DOUGLAS MCCANDLISH, of the Department of Leather Industries of the University of Leeds, has been appointed honorary director, and Mr. W. R. Atkin honorary research assistant, of the Procter International Research Laboratory.

THE Bradshaw Lecture of the Royal College of Surgeons of England will be delivered at the College in Lincoln's Inn Fields by Sir James Walton, on December 14 at 3.30 p.m. The subject of the lecture will be "The Surgery of the Common Bile Duct".

A LEAGUE against syphilis and other venereal diseases has been founded in Cuba under the auspices of the Cuban National Institute of Social Welfare.

THE Central International Seismological Bureau has removed from Strasbourg to 9, boulevard de la Pyramide, Clermont-Ferrand, France, from which address it will continue to function as hitherto.

AN Elgar scholarship in naval architecture of the value of £130 per annum for three or four years is now being offered. Entries close on January 15, 1940. Full particulars may be obtained from the Secretary of the Institution of Naval Architects, 10 Upper Belgrave Street, London, S.W.1.

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. They cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

IN THE PRESENT CIRCUMSTANCES, PROOFS OF "LETTERS" WILL NOT BE SUBMITTED TO CORRESPONDENTS OUTSIDE GREAT BRITAIN.

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 945. CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

An Experiment on the Effects of γ-Radiation on the Grain Weevil

THE use of X- and γ-radiation as a means of control of insects attacking stored products has never been fully investigated. We have recently made some experiments on the action of γ-rays on the weevil *Calandra granaria*, which, although of only a preliminary nature, are of interest inasmuch as they show that the control of these pests by radiation is possible, under laboratory conditions at least.

Weevils were exposed to the mixed β- and γ-rays from 10 gm. of radium. The radium was contained in 50 monel metal tubes 13 mm. long × 5 mm. in diameter and having a wall thickness of 0·5 mm., closely packed side-by-side to form a cylindrical slab 40 mm. in diameter and 13 mm. deep.

One hundred adult weevils of mixed ages were put into a shallow celluloid box 40 mm. in diameter and 10 mm. deep, provided with air holes in the lid and a thin celluloid sheet 0·25 mm. thick on the underside.

The box was placed directly over the radiation source so that the thin celluloid underside rested on the tops of the radium tubes. On account of the low filtration (0·5 mm. monel + 0·25 mm. celluloid) a considerable amount of β-radiation was transmitted to the weevils, in addition to γ-radiation.

A similar celluloid box also containing 100 weevils was kept near by, shielded from radiation, to serve as a control.

At the beginning of the exposure the weevils were crawling slowly around the bottom of the box in their usual fashion. Under the action of the radiation they began to move faster, and towards the end of the exposure, which lasted one hour, they showed a very lively motion. This increased activity was not due to local heating, for a thermometer placed over the radium tubes showed no significant rise of temperature

After exposure, all the insects were alive and had resumed their normal rate of movement. They were transferred to a jar of grain and incubated at a constant temperature of 27° C. The controls were treated similarly.

At first, it seemed as if the radiation had produced no effect, for living insects were observed from time to time in the jar containing the exposed culture. After an interval of two months, however, both jars were carefully examined. It was found that the exposed culture contained no living insects, whereas the control culture was flourishing. Thus it appeared that exposure to radiation had sterilized the weevils and prevented them breeding.

Unfortunately it was not possible to get a measure of the radiation dose, as the radium had to be put underground soon after the outbreak of war, as a precaution against air attack. The γ-ray dose at the centre of the celluloid box may, however, be roughly estimated at 35,000 röntgens per hour. To this must be added the contribution of the β-radiation; this cannot be reckoned with any degree of accuracy owing to the complexity and uncertainty of the screening corrections. Nevertheless, it seems likely that the total dose delivered in one hour by β- and γ-rays together was of the order of 10^5 röntgens.

To deliver a dose of this magnitude to a fast-moving stream of grain entering a silo bin would not seem a practical procedure at the moment, but the development of X-ray plants of large radiation output may some day make this feasible. It should be remembered also that sterilization of insects may be possible with smaller doses of radiation than were given in this particular experiment.

However this may be, we feel that the principle involved is of sufficient interest to warrant a fuller investigation, which we hope to carry out when circumstances permit.

We gratefully acknowledge the loan of 8 gm. of radium by the Union Minière du Haut Katanga.

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Nov. 6.

Local Growths in Animals Produced by Injection of Intercellular Wound Hormones

THE following preliminary experiments show that intercellular wound hormones[1], produced by living cells as a physiological response to injury[2], induce local overgrowths when injected repeatedly into rats and mice.

The wound hormones were prepared by mincing whole rat or mouse embryos, or adult rat spleens, washing the minced tissues and suspending them in isotonic salt solution, irradiating the cell suspensions with lethal ultra-violet, and obtaining the intercellular fluids (containing the wound hormones) free from cells by centrifugation and Berkefeld filtration. Control fluids were obtained from tissues treated similarly except that irradiation was omitted. All manipulations were carried out aseptically and (prior to centrifugation) at body temperature. The details of the technique have been reported elsewhere[3].

The fluids were injected subcutaneously over the abdomen in 0·5 c.c. quantities. In the first two series of experiments (using white mice) injections

were made thrice weekly; in the third series (using white rats) they were made twice weekly. Six to eight weeks after starting injections, all animals in the test groups of all series developed hard, tumour-like masses near the site of injection, or, in some instances, on the tails or feet. These continued to persist, and usually to grow in size, until the animals were killed at the end of ten to twelve weeks. A typical tumour removed at autopsy weighed 1·15 gm. Histological examination of the overgrowths showed them to be composed largely of connective tissue and striated muscle.

Control fluids led in some cases to the development of similar but much smaller and less persistent growths. In this connexion, it must be remembered that some wound-hormone production would be expected in the control preparations because of unavoidable mechanical injury to the tissues, since it has been demonstrated that mechanical injury leads to the production of such factors[4].

The work is being extended with more highly purified preparations, and will be described in detail when the current investigations are completed.

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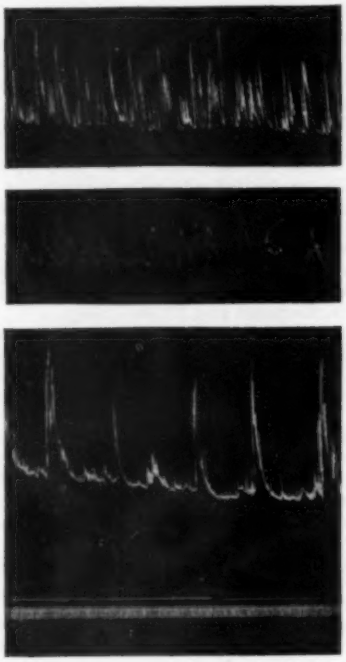
Intermittent Activity in Polychaete Worms

THE undulatory movements by means of which Nereis renews the water in its burrow are well known. Lindroth[1], in a recent study of respiration in *N. virens*, finds that the movements are intermittent in this species. "Ventilationsperioden von etwa 5 Minuten Länge werden von Ruheperioden von 20 bis 30 Minuten abgelöst". He quotes instances of other polychaetes, in which ventilation periods alternate with rest periods.

Lindroth explains this intermittent activity as follows. When the worm is quiet, the contents of the burrow can be regarded as a closed system. Owing to the metabolism of the worm, oxygen gradually disappears and other substances accumulate. Finally, an unspecified chemical factor acts as a stimulus and evokes the respiratory waves. The resulting renewal of the water in the burrow soon removes the stimulus, so the movements cease again.

It would, however, be unwise to adopt this simple and attractive hypothesis unless the actual chemical stimulus can be experimentally identified and demonstrated. Intermittent rhythmic activity is very commonly shown by isolated nerve-muscle preparations of polychaete worms and it often seems to be the normal activity pattern. I found[2] that *Arenicola marina* shows rhythmic outbursts of gulping or feeding movements alternating with periods of quiescence, and was able, by studying a series of dissected preparations, to localize the pace-maker for this intermittent activity in the walls of the œsophagus. Wu found[3] that longitudinal ventral strips of the body wall of the same species (including the nerve cord) "often showed outbursts of rhythmic activity alternating with more quiet periods". I observed[4] similar activity outbursts (although in this case only exceptionally) in dissected preparations of Glycera. Miss I. C. Ledingham and I have just completed a study of the action of low salinities on isolated rhythmic preparations from polychaete worms. This involved taking kymograph records of great numbers of longitudinal ventral body wall strips (including



the nerve cord) and of 'isolated extroverts' (that is, the proboscis and part of the œsophagus, with the stomatogastric nervous system but without the circum-oral nerve ring or brain) from *Nereis diversicolor* and *Perinereis cultrifera*. We find that regularly intermittent activity very commonly appears, especially in preparations from the latter species, in which it seems to be the normal pattern.

The accompanying records, taken by Miss Ledingham and me, show two body wall strips (above) and an extrovert (below) from *Perinereis cultrifera*—all from different individuals. The preparations were suspended in a large volume of sea water, well aerated, at 16°–19° C., and the movements were recorded by light isotonic levers. The time signal marks minutes. The occurrence of periodic 'activity outbursts', in both parts of the nervous system, is obvious. Sometimes the body wall strips give records like that of the extrovert in the figure, that is, short, vigorous outbursts at long intervals.

Except in the case of the *Arenicola marina* extrovert, where the intermittent rhythm is very steady and regular and its normality can scarcely be doubted.

the contractions of these isolated preparations have yet to be interpreted in terms of movements of the whole animal. The frequent occurrence of intermittent activity in body wall stripe suggests, however, that the periodic ventilation of Nereis may result from the inherent nature of its nervous mechanism, and not from the alternating accumulation and removal (by the ventilation movements themselves) of metabolites.

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Temporarily at:
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Oct. 24.

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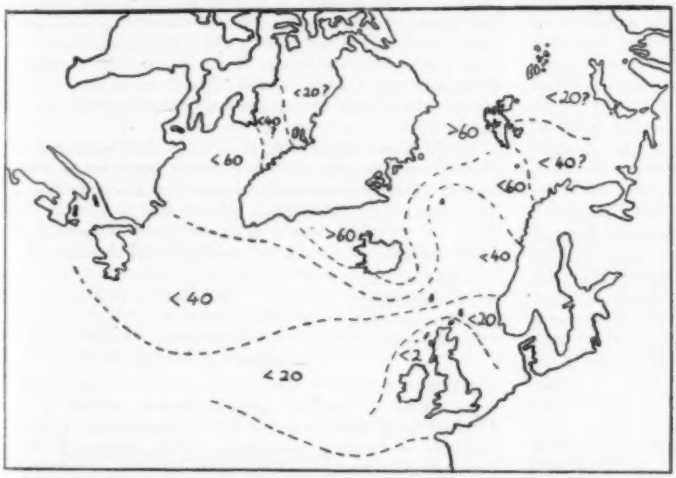
Distribution of the Colour Phases of the Fulmar (*Fulmarus glacialis*)

CHARACTER gradients[1] in animals are receiving so much attention that additional raw material, particularly of a quantitative kind, is urgently required.



PERCENTAGES OF 'DARK' FULMARS IN THE NORTH ATLANTIC (SUMMER BREEDING AND OCEANIC DISTRIBUTION).

The ornithologists, who by reason of their numbers have already made a good start with the distribution of the 'bridled' form of the guillemot (*Uria aalge*)[2,3], might now well extend their observations to the fulmar (*Fulmarus g. glacialis*). Unlike the guillemot, the fulmar does not exhibit a simple 'dimorph-ratio cline', but shows a polymorphic one (first discussed by Eagle Clarke[4]), which seems, from the limited evidence available, to be of a rather complicated nature. The accompanying distribution map, compiled from twenty-six literature sources, gives a general indication of the situation.

Every stage between almost white and dark 'blue' plumage is found in the fulmar. The darkest specimen examined (from Bear Is.)[5] seems to be Ridgway's[6] *chaetura drab* (pl. xlvi) on the back, and on the breast between *mouse-grey* and *deep mouse-grey* (pl. li), a plumage very similar to that of the dark form of the North Pacific subspecies, *F. g. rodgersii* (a race in which a similar polymorphism appears to exist).

To prepare the map, birds have been held to be 'dark' or 'light' according to which side they fall of the arbitrary mean suggested by Roberts[7]. I have attempted to interpret the literature in terms of this mean.

The maximal preponderance of dark forms seems to extend from Iceland seas (excluding, apparently, the Iceland breeding stock) via east Greenland to west Spitsbergen. Towards Bear Island, there is a slight diminution in the proportion, and the Jan Mayen birds appear to be predominantly of the lighter forms, as are those of the Faeroes, which were only colonized between 1816 and 1839. In Britain dark forms are extremely rare (only, it seems, about 2 per cent); with the exception of the large colony on St. Kilda (*circa* 20,000 pairs), the rest of the British population (*circa* 40,000 pairs) has established itself since 1878.

The situation east of Spitsbergen is obscure, but it is probable that the gradient falls somewhat sharply in that direction. The birds' distribution extends eastwards as far as Lonely Island (Einsamkeit).

From the West Atlantic information is also scanty, but the numbers of the dark forms seem to reach a peak of 40–60 per cent in the south of Davis Strait and may fall off northwards towards Baffin Bay, and southwards towards the Newfoundland Banks.

Examination of skins, and observation in the field, indicate that the polymorphic forms, though exhibiting every gradation, can be arbitrarily grouped in four main classes:

DD (double dark). Underparts uniform very dark or dark blue-grey, head and neck dark.

D (dark). Underparts uniform medium or light blue-grey, head and neck dark.

L (light). Underparts white, near-white, or white flecked or shaded with grey; on crown, nape and hind-neck grey colour continuous with that of mantle.

LL (double light). Underparts white, or near-white, head and neck white.

Roberts's arbitrary mean lies between *D* and *L*.

I shall be very glad to receive any counts of the relative numbers of these forms, either at colonies or on sea-transects. In the latter case it will be useful to give at least the noon positions of any voyaging ship from which a series of observations is taken.

JAMES FISHER.

Zoological Society of London,
Regent's Park,
London, N.W.8. Oct. 31.

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Rules of Zoological Nomenclature

SUCH cases of the abuse of the rules of zoological nomenclature as are indicated by Prof. W. Garstang in NATURE of September 9 indicate a failure in the functioning of the present rules which is an ever present danger and hindrance to the work for which systematic researches exist. The existing rule that no names shall be changed if the result will be greater confusion than uniformity needs enforcement. At present, this can only be done by a long and cumbrous procedure which has resulted in comparatively few, a few hundred, *nomina conservanda*, and those generally only of common genera, and very few species. It is also unfortunate that this remedy comes after the damage has been done. The position needs something much more rapid and thorough which, under the present scheme, would mean the appointment of whole-time searchers in each group, who would present lists of a thousand or so names annually to a committee of superhuman patience. Such a scheme is utterly impossible.

Are there any alternatives? I suggest that the old rules, having served well in the old days, should now be altered radically. Consider how different is our position now. We have a vast body of systematic literature, upon much of which the most careful labour of the most skilled observers has been freely and generously expended. This vast labour has not been, for the most part, an end in itself; its essential value is to be the foundation of such subjects as ecology and genetics. It must therefore be regarded as an essential tool, to be altered and adjusted only when we are compelled by dire necessity. What would become of a factory in which the machinery might be adjusted without reference to the work of the factory as a whole? This is exactly the danger the framers of the rules of nomenclature had in mind and tried to avoid, but which insistence on the letter of the law, and neglect of its spirit, has made rampant.

I venture, therefore, to recall a suggestion I made more than thirty years ago, which was approved by the late Sir Arthur Shipley and published in NATURE, namely, that a small committee of experts in each group should select the most useful books in each, the names in which should be unalterable for any literary or priority reasons. Conversation with my friends shows that I must enlarge a little; it seems to be taken that I mean the establishment of a kind of Holy Writ—an idea abhorrent to science. The committee on group *Z*, say, decides that the most useful books in that group are *A* . . . *H*, dated, say, 1850 to 1920 (for obvious reasons no book of very recent date could be included). It is then found that the author of book *E* published excellent descriptions of a number of species, but took little trouble over synonymy, and some of his species are the same, or, in the opinion of subsequent authors, should be reckoned as varieties of species described by the authors of *A*, *B* or *C*. The names used by the latter authors therefore have priority, and are to be used; research into literature, once important and useful, but now only of historic value, of older date than that of the book *A*, will not be allowed to upset *E*'s names. Criticism founded on new knowledge, or even individual views of the relationship of species and genera, would be as free as they are now. In this way thousands of names, species as well as generic, could be saved by one year's work.

Something might also be done by ignoring the so-called work of those who change names on trivial grounds, as sinners against the workers for whose convenience they, in fact, exist. The first necessity is that a worker who is not a specialist in systematics shall be able to get the description, variation and distribution of the species with which he is dealing with the least possible difficulty and the greatest possible certainty. Again I repeat, this is the end for which systematists work, and those who would put difficulties and delays in the way should receive every possible discouragement from all scientific workers.

CYRIL CROSSLAND.

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Birds of Britain

IN the review of the "Handbook of British Birds", vol. 3, in NATURE of October 21, p. 691, there are some criticisms which require an answer. Some are merely matters of personal experience. 'S. G.' has never seen bracken used for nesting by the golden eagle, but others have. Nests in trees have always been a small minority, except in one restricted district. As to the share of the sexes in providing food for the young, H. B. Macpherson, who watched a nest for long periods in 1909, records in his diary no fewer than twenty occasions on which the female brought food to the nest. A. Brook in his diary states that the hen brought a grouse and a young hare to the nest on June 14. While I agree, and have stated in the "Handbook", that the male takes the chief part in this work, it is impossible to ignore Macpherson's evidence, and 'S. G.', to whom I mentioned this fact, could give no explanation of the discrepancy.

May I quote one sentence from 'S. G.'s' own notes? "I believe that the cock [*sic*] must have come twice to the eyrie unperceived by me, for when I left the hide there were two more grouse in the nest." The eyrie in question was ten yards from where 'S. G.' kept watch.

F. C. R. JOURDAIN.

Whitekirk,
Southbourne,
Bournemouth.
Oct. 25.

DURING the past thirty-five years I have visited more than a hundred golden eagles' eyries in the Highlands of Scotland, yet I have never seen bracken used as a nesting material. This shows, I think conclusively, that bracken must be very rarely used.

Eyries in trees are certainly not in a "small minority". I used to know of at least seven pairs of golden eagles (some of them have now been driven away by the attentions of egg collectors) which almost invariably nested in trees. I should say, indeed, that tree-nesting golden eagles are in the majority in the Central Highlands although in a minority in the Western Highlands; yet even in the west I know of several eagles' eyries in trees.

During the years 1924–36, my wife and I watched for more than three hundred hours, throughout the day and night, at both rock and tree eyries of golden eagles, yet we never saw the female golden eagle carry in food. It was she who almost always *fed* the young, but the food was *always* brought by the male. This seems to show that at Mr. H. B. Macpherson's eyrie (he watched, I believe, only at one eyrie) the bringing of food by the female was exceptional.

S. G.

Synthesis of Coenzymes I and II

DURING the past year, two biological methods for the determination of coenzymes I and II in blood have been reported[1,2]. Kohn and Klein, using the method described by Kohn, have reported recently the *in vitro* synthesis of the pyridine coenzymes I and II by human erythrocytes[3]. In their study, "fresh defibrinated blood was incubated in tightly stoppered flasks, or tubes, for 18–24 hours at 29°–35°"; apparently a mixture of red cells, white cells and serum was used. In the presence of added nicotinic acid amide or nicotinic acid, the *in vitro* synthesis of these coenzymes by defibrinated blood had also been observed in this laboratory, but from our experiments it seemed that the red cells stored and carried the enzymes instead of performing the synthesis. Accordingly, we took duplicate samples of venous blood from five normal persons, two patients with myelogenous leukæmia, and one patient with lymphatic leukæmia, and by repeated washing separated the red blood cells, the white blood cells and the serum. In each case, 1 c.c. of venous blood, or its hæmatocrit equivalent of washed cells, was incubated 18 hours with an equal volume of saline which contained 0·25 mgm. of nicotinic acid amide per cubic centimetre. The control tubes contained no nicotinic acid amide and were incubated the same length of time with an equal volume of saline.

Repeated tests show that: (1) the concentration of coenzymes I and II in normal human blood and leukæmic blood is doubled after incubation with nicotinic acid amide; (2) carefully washed erythrocytes, however, from normal blood and leukæmic blood, resuspended in saline or serum, show no increase in the concentration of coenzymes I and II after incubation under similar conditions; (3) the concentration of coenzymes I and II is greatly increased in a suspension of white cells of the lymphoid and myeloid series after incubation with nicotinic acid amide.

The above findings are inconsistent with the statement of Kohn and Klein that the normal erythrocytes accomplish the synthesis of coenzymes I and II after incubation with nicotinic acid, and suggest the tentative hypothesis that nucleated cells are essential for the synthesis of these complex enzymes.

S. P. VILTER.
R. W. VILTER.
T. D. SPIES.

Department of Internal Medicine,
University of Cincinnati College of Medicine,
Cincinnati, Ohio.
Oct. 13.

[1] Kohn, H. I., "The Concentration of Coenzyme-like Substances in Blood Following the Administration of Nicotinic Acid to Normal Individuals and Pellagrins", *Biochem. J.*, **32**, 2075 (1938).
[2] Vilter, R. W., Vilter, S. P., and Spies, T. D., "Relationship Between Nicotinic Acid and a Codehydrogenase (Cozymase) in Blood of Pellagrins and Normal Persons", *J. Amer. Med. Assoc.*, **112**, 420 (Feb. 4, 1939).
[3] Kohn, H. I., and Klein, J. R., "The Synthesis of Cozymase and of Factor V from Nicotinic Acid by the Human Erythrocyte *in vitro* and *in vivo*", *J. Biol. Chem.*, **130**, 1 (1939).

Benzedrine and Brain Metabolism

THE unquestioned value of benzedrine (phenylisopropylamine) in the treatment of narcolepsy has made it of interest to discover in what ways this drug might influence metabolic events in the nervous system.

It has been known for some time[1] that the presence of amines such as tyramine or isoamylamine brings about a marked diminution in the respiration of brain examined *in vitro*. In spite of the fall, however, of the oxygen uptake of brain tissue respiring at 37° in a glucose phosphate medium, oxidation of the amine[2] may take place with the formation of ammonia and the corresponding aldehyde[3]. The enzyme responsible for the oxidation of the amine has been termed amine oxidase, and it has been proved[3] that certain amines which are but feebly or not attacked by the oxidase nevertheless combine with the enzyme and compete with amines which are vigorously oxidized. Among such amines[4] is benzedrine which, whilst suffering little or no oxidation by the amine oxidase of brain, greatly inhibits the oxidation of tyramine or isoamylamine in the central nervous system.

It has now been found that the fall in brain respiration brought about by the presence of tyramine or isoamylamine can be partially or wholly relieved by the addition to the system of small quantities of benzedrine. This phenomenon is shown by the results given in the following table. The effect of adding benzedrine to brain tissue consuming oxygen in the presence of glucose and of tyramine is greatly to stimulate the oxygen uptake.

OXYGEN UPTAKE AT 37° OF GUINEA PIG BRAIN TISSUE IN PRESENCE OF GLUCOSE-PHOSPHATE AFTER 2 HOURS EXPOSURE TO BENZEDRINE, TYRAMINE AND A MIXTURE OF BENZEDRINE AND TYRAMINE.

Amine present	μl O_2 uptake in 1 hour	
	Expt. A.	Expt. B.
Benzedrine sulphate (0·03%)	193·6	177·7
Tyramine (0·03%)	71·1	90·1
Tyramine (0·03%) + Benzedrine sulphate (0·03%)	198·5	170·8

The facts show that the diminution of brain respiration brought about by the amine $R.CH_2NH_2$ when present at low concentrations is not due, or wholly due, to the presence of the free amine but to the accumulation of the aldehyde R.CHO formed as a result of oxidation of the amine by the amine oxidase. Benzedrine owes its stimulating effect on brain tissue respiration in the presence of $R.CH_2NH_2$ to its inhibitive action on the formation of R.CHO. Owing to the competition between benzedrine and $R.CH_2NH_2$ for amine oxidase, the greater the quantity of the inhibitory amine present the greater is the quantity of benzedrine required to neutralize the inhibition of brain respiration.

The molecule R.CHO, for example, isovaleric aldehyde, has been found to be highly toxic to respiratory processes in brain, and this toxicity is not influenced by the presence of benzedrine.

Benzedrine at low concentrations, for example, 0·001 per cent, has little influence on the oxygen uptake of brain when this respires in a glucose medium in the absence of an inhibitive amine; its stimulating effect is only observable if an amine such as tyramine is also present. At relatively high concentrations benzedrine itself exerts large inhibitive effects on brain respiration. Such effects are due to causes other than aldehyde formation.

Benzedrine does not neutralize the inhibitive action on brain respiration of narcotics such as the barbiturates, or of a drug such as bulbocapnine. Its effect appears to be confined to the amines capable of aldehyde formation in the central nervous system.

It is permissible to suggest, in view of these facts, that the clinical effects of benzedrine administration may be related to respiratory changes in the brain. It would be of interest to discover whether there accumulates in conditions of narcolepsy toxic bodies (? aldehydes) the formation of which is retarded by the administration of benzedrine

Details of the experimental results recorded above will be published shortly.

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J. H. QUASTEL.

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Cardiff City Mental Hospital.
Oct. 26.

[1] Quastel and Wheatley, *Biochem. J.*, **27**, 1609 (1933).
[2] Pugh and Quastel, *Biochem. J.*, **31**, 286 (1937).
[3] Pugh and Quastel, *Biochem. J.*, **31**, 2306 (1937). Blaschko, Richter and Schlossmann, *Biochem. J.*, **31**, 2187 (1937).
[4] Pugh and Quastel (unpublished).

Factors Determining Physical Size and Proportions

THE mathematical methods[1] devised to deal with the analysis and distribution of human ability and temperament[2] can be fruitfully applied to problems of isometric and allometric growth[3] and to those of physical anthropology[4].

A factorial analysis was undertaken of fourteen anthropometric measurements obtained from two separate adult male samples, one consisting of 64 mental patients heterogeneous for age and disease, and the other of 50 university students homogeneous for age and social status. The two independent analyses gave strikingly similar results.

Without identifying statistical entities with biological principles, it was shown that physique, in general, could be most usefully regarded as the resultant of two relatively independent factors or sets of processes, one determining the growth (or size) of the body as a whole in its various dimensions, and the other determining disproportionate development in length or circumference of the body. The establishment of racial or constitutional (growth) types would have to be based on a study of these two factors separately. These factors may ultimately be explicable in metabolic and genetic terms. The conventional indexes of somatometry would, if this view be correct, give little hope of revealing true racial or growth type differences, since 'type', as defined by excessive linear or circumferential development, is masked by the general processes governing size, and this latter factor would have to be statistically controlled if 'type' is to become evident.

As regards the problem of physique and nutrition, the implication seems to be that two norms would be required: a norm for general or uniform development of the body, and another for typological variations.

Three measurements of the head, four of body length (arm, leg, trunk, stature), three of body breadth (shoulder, chest, pelvis), three of body circumference (chest, waist, pelvis) and one sagittal (chest depth) were used. Coefficients of variation for the measurements descended in this order of magnitude: circumferential, sagittal, breadth, length, head. Of all the fourteen measurements, breadth and circumference of the pelvis and waist circumference were found most informative (that is, most discriminative) of general size or growth, and leg length together with circumference of waist and pelvis most informative of typological characteristics when the size influences are statistically controlled.

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[1] Thomson, G. H., "The Factorial Analysis of Human Ability" (Univ. of London Press, 1939).
[2] Burt, C., *Brit. J. Med. Psychol.*, **17**, 158 (1938).
[3] Huxley, J. S., and Teissier, G., *C.R. Soc. Biol.*, **121** (1936).
[4] Clark, W. E. Le Gros, NATURE, **144**, 804 (1939).

Surface Features of Mars at the Recent Opposition

ADVANTAGE has been taken of the recent very favourable opposition of Mars to make a close examination of the surface features. The 9 in. Cooke photo-visual refractor has been employed, usually with a magnification of 250. A fortnight of reasonably clear weather at the end of July assisted considerably, and nearly one hundred drawings of the disk have been made. The following is a summary of the chief points of interest revealed by these:

(1) Vast changes appear to have occurred on the north-east edge of Mare Cimmerium, where an apparently new dark marking has appeared. This seems to occupy the region of Cyclops and Cerberus II, Pambotis Lacus having apparently become merged in it. It is separated from the main Mare Cimmerium by a narrow isthmus, broader at the north end and very prominent under certain illuminations. At the end of July it was very plain and obvious, being one of the darkest markings on the planet. The reduction of the numerous drawings of it has yet to be made, so that exact positions are not available at present.

(2) Until July 22, Hellas was bright and obvious with a sharply defined margin, particularly on the west, but on July 23 it has become dark and hazy with a much less definite outline. It remained so at every subsequent observation. At all times, even before July 23, it was darker than the remainder.

(3) Edom Promontorium became very plain towards the end of August and was one of the most prominent features. Earlier, a white region in Ausonia showed up very plainly.

(4) Iuventæ Fons showed as a dark point on July 10 but was not seen again, despite a close search for it.

(5) The North Polar region was a very interesting feature. Apparently it was covered by a very eccentrically situated cap of fog or ice. At times this was invisible but on other occasions it extended well on to the disk. Probably this can be accounted for by the rotation of the planet, although this point has not yet been investigated. Generally it was duller than the South Polar Cap, but on July 25 it was equal to it in brightness, while on August 4 it quite outshone everything on the disk, the South Polar Cap appearing very dull in comparison.

Various other features of interest have been noted, particularly in the Solis Lacus region, but, until the final reduction of the observations is complete, it is impossible to discuss them fully. It is hoped to publish the entire results in due course.

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I. L. THOMSEN.

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Wellington, W.1,
New Zealand.
Sept. 19.

Measurements of the Velocity of Light

M. E. J. GHEURY DE BRAY suggests[1] that measurements of the velocity of light show that it is changing according to a formula :

$$c = 299{,}900 - 3{\cdot}855\,T, \qquad (1)$$

T being measured in years from 1900.

Assuming that Planck's constant and the energy E given out by an excited atom remain unchanged, the relation

$$E\lambda = ch \qquad (2)$$

shows that a change in c must be accompanied by a proportional change in λ. But the wave-length of the red calcium line has remained constant to within one part in five million for thirty years, only 0·5 per cent of the change required by (1).

It is probable that there are unsuspected systematic errors in the determinations of c.

KITCHENER.

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Cambridge.

[1] NATURE, **144**, 285 (1939).

THE decrease of velocity of light deduced from the red-shifts is of the order of 1 km./sec. in 6,000 years, or 1 in 600,000,000 for thirty years, which is quite consistent with the apparent constancy of the wave-length mentioned by Lord Kitchener. Our observations, being affected by unsuspected systematic errors, and covering only a third of a century, give what is probably a greatly exaggerated rate of slowing down. The remarkable fact is that *all* the determinations are unanimous in indicating the existence of such a variation, and the red-shifts, if interpreted so as to escape from fantastic results, confirm it.

The Table 1 of the communication referred to cannot be dismissed on the ground of "unsuspected systematic errors". It is admitted that the method of the revolving mirror may suffer from physical bias, but no such reproach can be levelled against the toothed wheel method, which is only open to objections of a physiological nature. These can be readily overcome by substituting for the observer's eye a photo-electric sensitive device. While France and the United States share between them practically the whole initiative in the measurement of c, Great Britain has only to her credit a conspicuous failure. Is there in this country no one who can redeem it from this position and settle this question, which lies at the basis of physical science, considered in its broadest aspect ?

Two observations, of Newcomb (1882·7 : 299860) and of Michelson (1882·8 : 299853) agree so closely that, if we consider that they were made by different observers, working independently with different instruments and different techniques, in different places, they must be extremely accurate, despite their large probable errors. It is significant that the second in date gives a lesser value of c.

M. E. J. GHEURY DE BRAY.

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Petts Wood.
Nov. 2.

Points from Foregoing Letters

L. G. Grimmett and G. V. B. Herford describe an experiment to test the possibility of controlling insect pests by means of radiation, in which it appeared that grain weevils (*Calandra granaria*) were sterilized by a radiation dose of β- and γ-rays estimated at 10^5 röntgens.

Injection into rats and mice of intercellular wound hormones, produced by injuring tissue cells with lethal ultra-violet, was found to produce local overgrowths, in investigations of J. R. Loofbourow, A. A. Cueto, D. Whalen and Sister M. M. Lane. The tumours were composed mainly of connective tissue and striated muscle.

G. P. Wells discusses the frequent occurrence of intermittent rhythmic activity in isolated preparations from polychaete worms.

J. Fisher describes the distribution of the colour-phases of *Fulmarus glacialis*, and shows the existence of a polymorph-ratio cline. The dark types are most numerous in the neighbourhood of south and east Greenland and west Spitsbergen, and fall off in proportion northwards towards Baffin Bay, and southwards towards the Newfoundland Banks and the British Isles ; in the latter they constitute less than 2 per cent of the population.

C. Crossland expresses dissatisfaction with the working of the rules for zoological nomenclature, on the grounds that the present methods of making *nomina conservanda* are too cumbrous, and he proposes an alternative method. He points out that the work of the systematist is not an end in itself, but exists that workers in such subjects as ecology and genetics may, with rapidity and certainty, find out what is known of the species' structure, relationships, distribution and ecology ; any interference with the literature which hinders this end should be discouraged.

P. J. G. Mann and J. H. Quastel show that benzedrine stimulates the oxygen uptake of brain *in vitro*, when this respires in the presence of certain amines. This is accomplished by an inhibition of the formation in brain of toxic aldehydes.

An investigation is reported by J. I. Cohen in which factorial methods of analysis, as used in psychometry, are applied to anthropometric measurements. The results suggest that physique may be regarded as determined by two sets of processes, one governing growth (or size) in all body dimensions and the other, relatively independent of the first, governing specifically linear or circumferential development.

Lord Kitchener shows that, with certain assumptions, a large secular change in c is inconsistent with the observed constancy of spectral wave-lengths. M. E. J. Gheury de Bray points out in reply that the decrease of velocity of light deduced from the red-shifts is 1 in 600,000,000 for thirty years, which is not inconsistent with the apparent constancy of the red calcium line. It is suggested that the toothed-wheel method in combination with a photo-electric sensitive device should be used to re-determine the velocity of light.

RESEARCH ITEMS

Prehistoric Rock Pictures in Dutch New Guinea

ROCK PAINTINGS collected in the islands off the coast of the Onia Peninsula, Dutch New Guinea, by members of the Frobenius Expedition in 1932 have been described and figured by J. Röder (*Man*, Nov. 1939). The paintings—there are no engravings—have been executed in grooves and hollows of the cliffs, washed out by sea-spray, which form a series of galleries, following the coast-line at a height of two to four metres above high-water mark. Apart from quite recent drawings, three layers can be distinguished. For the most ancient, red paint is used. In this layer four styles can be recognized, though there is a far-reaching uniformity of subject. In the earliest style, however, the most characteristic subject is the silhouette of the hand, with silhouettes of feet and arms. The hands occur in dozens on the same wall—right hands, left hands, hands of children, but only rarely with mutilated fingers. In aboriginal tradition these mark the wanderings of the ancestral immigrants, who were blind. In later styles of the red paint layer, the hands are absent, but other subjects are much the same—fish, trepang, crocodile, lizards, and man, at times scarcely to be distinguished from an animal. Often, apart from the big find spots, the human figures are surmounted by a large head-dress like a pointed nightcap, the hands being raised as in adoration. These are now said to be representations of ancestors. The sex is prominently characterized; and sometimes the figure is so abbreviated that only the sign of sex remains. Here is evidently a fertility cult, which survives to-day in the use of wooden figures. Subjects in black paint point to a different culture in which the boat is prominent—previously unrepresented, but now taking a part in cult. There is in this layer a progressive degeneration in style and execution. Paintings in white are mostly superimposed on the red, as if a comment were intended. Caves with pictures of both the red and black periods are found. A cave deposit on excavation revealed three cultural layers, of which two contained pottery, but the lowest flint implements only. A figure on a stalactite pillar with arms upraised was evidently an ancestral figure or deity to which, presumably, offerings had been made on a stone showing traces of red from the second cultural layer. Burials in the semi-caves were made up to represent boats.

Basque Origins

THE results of recent research on the origins and affinities of the Basques, which had been interrupted by the Civil War, are reviewed by Mr. Rodney Gallop in the course of an account of the people appearing in *Discovery* of October. The most recent researches tend to confirm the 'positivist' view of Julien Vinson that "from the earliest times the Basques have never been more than a small tribe dwelling in a few valleys of the Western Pyrenees". The basis of the confirmation is archæological and anthropological rather than linguistic, and rests on the existence of a uniform culture in north-west Spain and south-west France from palæolithic times onward, belonging to a people whose skulls, found on both palæolithic and neolithic sites, correspond closely with a type which predominates among the Basques of to-day, but is found but rarely among the adjacent French and Spanish populations. This type lies between the brachycephalic and dolichocephalic, and is distinguished by prominent temples, high cheek-bones, a narrow loose jaw, a long pointed nose, and a projecting chin. The affinities between the Basque and Iberian languages, demonstrated in place-names and fragmentary inscriptions found almost all over Spain, are possibly to be explained as due to adoption or free borrowing by the primitive Pyrenean ancestors of the Basques on first contact with the relatively advanced Iberians. Antiquity is stamped on Basque syntax and vocabulary, the latter pointing to a derivation from an age of stone and a time reckoning of a three-day week. Caution is necessary in cultural analysis; and although it is true that the Basque cultural heritage is distinct from that of their neighbours, a careful comparative study of Basque traditional peasant art reveals numerous analogies with the common stock of European tradition.

Nitrogenous Excretion from Root Nodules

FOLLOWING the experiments of A. Virtanen of Helsinki, G. Bond and J. Boyes have investigated the possible excretion of nitrogenous substances from the root nodules of the leguminous plants, soya bean, garden pea and broad bean (*Ann. Bot.*, N.S., **3**, No. 12, 901; 1939). Three different grades of sand were used, and in some cases, soil. In spite of Virtanen's claim that extensive excretion was frequently obtained, these authors obtained consistently negative results from their experiments similarly carried out with sand cultures. The soil cultures were inconclusive. The discrepancy may be explained by the presence of considerably more direct sunlight at Helsinki than at Glasgow; but this has yet to be established.

Polyploid Cells in *Cucumis Melo*

C. D. ERVIN (*Proc. Nat. Acad. Sci.*, **25**, 335–338; 1939) shows that the production of tetraploid cells in the periblem of roots is a common and frequent occurrence. Rarely is the plerome affected, and octoploid cells are infrequent. The number of tetraploid cells increases towards the older portions of the root. Secondary pairing of chromosomes is often evident in tetraploid cells.

Coasts of Cardigan Bay

IN a study of the present-day coastal forms in Cardigan Bay ("Sand and Shingle Formation in Cardigan Bay", *Geog. J.*, Sept. 1939), Mr. J. A. Steers, dealing particularly with the shore between Pwllheli and Fairbourne, shows that there is a steady movement of beach material towards Tremadoc Bay. Along the Lleyn coast this material moves eastward, and along the Merioneth coast in the main northward. Both movements are the result of prevailing south-westerly winds which cause the waves to strike at an oblique angle and so move the material. Material brought down by the rivers Glaslyn and Dwyryd has helped to shallow Tremadoc Bay. The north-eastern re-entrant shows great sand-flats produced by the beach drift. This accumulation has caused the waves

to break on a constantly shallowing bottom, progressively farther and farther from the mainland. Consequently Morfa-Harlech and Morfa-bychan have grown seaward with their outer beaches at right angles to the main direction of wave approach. Between them the rivers have maintained an open channel. These processes are still continuing.

Damage by Spray Fluid

IT is most important that a spray fluid applied for the control of insect or fungal attack shall not produce any injury of the host plant. This is unfortunately the case with many Cucurbitaceous crops in America, which cannot be sprayed with Bordeaux mixture without considerable stunting and loss of yield. James G. Horsfall, G. E. R. Hervey and R. F. Suit have investigated this damage (*J. Agric. Res.*, **12**, 911–928, June 1939) and find that it is at a minimum when the spray fluid is neutral. Changes in the hydrogen ion concentration either towards alkalinity or towards acidity bring about dwarfing and leaf deformation, for both the copper factor and the lime in the mixture play their part in producing damage. Reduced photosynthesis, the hardening of young cells by the calcium ion, and physiological drought of the tissues when Bordeaux mixture is present, appear to be the main causes of injury. The obvious remedy, namely the use of neutral spray fluid, is not regarded as practicable under agricultural conditions, but further research should ultimately indicate the appropriate practice.

Fog in the Netherlands

IN *Mededeelingen en Verhandelingen*, **42** (Kon. Ned. Met. Inst.), Dr. C. Braak discusses the occurrence of fog in the Netherlands, as revealed by observations made at eighty-two observing stations well distributed over that country. On the basis of Hann's classification, according to which a place with less than 25 fog days per annum is not a foggy place but one with more than 50 fog days can be regarded as foggy, the Netherlands occupies an intermediate place only, which fact will perhaps come as a surprise to many, for low-lying country with so many dykes and such an indented coast-line, and one containing extensive manufacturing districts, might have been expected to be conspicuously foggy. Dr. Braak offers no explanation, and one can only suppose that the generally open character of the country allows the wind to circulate very freely—the presence of so many windmills is suggestive of this being the case—and that this generally prevents the air from becoming stagnant enough for fog to form. The annual number of fog hours deduced by Köppen's method is 442 at Amsterdam (Filiaal) but only 157 at Amsterdam (Hortus). In general, the figure lies between 200 and 300, at lightships as well as on land. Of particular interest are four charts, Figs. 3–6, showing the percentage of the year's fog days that occurs in each season. It might have been expected that these would show broadly a tendency for fog to be most frequent in winter at places farthest from the sea, which would most often be under the influence of Continental anticyclones, while the coastal towns and lightships would have most of their fogs in the early part of the summer. This is definitely not the case. It would be more accurate to say that in general winter (December–February) is the time for fog, even at the lightships, and that in the north-west more than half the year's fogs occur in the winter quarter. There is a general falling off in fog frequency in the spring (March–May) quarter, and over a large proportion of the country the months June to August yield less than 5 per cent of the year's total, 10 per cent being exceeded only at lightships. It is only in autumn that distance from the sea and fog frequency show a marked tendency to be associated. It must be remembered, however, that on the Continent the available water vapour is reduced by frost in winter more often than in the British Isles, and this reduces the number of fogs in the coldest part of the winter and tends to make the annual maximum frequency fall earlier than in the latter.

Reaction of Fluorine with Carbon

MOISSON in 1890 obtained carbon tetrafluoride, CF_4, by the action of fluorine on carbon, and Ruff and Keim (1930) showed that hexafluoroethane, C_2F_6, and possibly higher compounds were also formed. J. H. Simons and L. P. Block (*J. Amer. Chem. Soc.*, **61**, 2962 ; 1939) have further investigated the reaction, which is complicated by explosions unless the reaction tube is heated just below dull red, and the carbon is mixed with amalgamated copper gauze or with a small quantity of mercurous or mercuric chloride. The liquid product was fractionated, and the following compounds isolated : CF_4, C_2F_6, C_3F_8, C_4F_{10} (two isomers), C_5F_{12}, C_6F_{12} and C_7F_{14}. The first five are gases, the rest liquids. The probable synthesis of a large number of similar compounds is inferred. Their physical properties approach very closely those of the inert gases.

Nature of Radio Fade-out

A PAPER (*Phys. Rev.*, March 15) by L. V. Berkner discusses the nature of radio fade-outs in the earth's sunlit hemisphere which are coincident with bright solar chromospheric eruptions and with certain geomagnetic effects of a specific character described by Fleming and McNish. They are examined by means of the vertical incidence recording of ionospheric echoes with a wide range multi-frequency technique. It is concluded by examining a series of observations that a fade-out is best described as an upward projection of the lower (absorption) limit of echo return, and that it is caused by intense absorption of ionizing radiation which emanates from bright chromospheric eruptions either at the base, or below, the *E* region, that is, below the 110 km. level. It is shown that no appreciable absorption of chromospheric-eruption radiation takes place at a height greater than that of the *E* region. Hence a process of selective absorption must operate. The localization of the region of intense absorption to space below the 110-km. layer, is interesting. An analysis of geomagnetic effect during a number of fade-outs observed by McNish shows it to be an augmentation of the diurnal variation of terrestrial magnetism. This is proved by the fact that not only is the magnetic vector of the associated geomagnetic effect always in the same direction as the diurnal variation, but also these vectors agree in direction at locations where the diurnal variation vector appears anomalous. It is not only similar in character to the diurnal variation but must also arise in the same atmospheric regions, and, therefore, must in fact be a part of it. It appears from the state of the theories that only the Stewart-Schuster 'atmospheric dynamo' theory of diurnal variation is possible, taking into account the restrictions imposed by these observations.

EUROPEAN ORDER AND WORLD ORDER

POLITICAL and Economic Planning (P.E.P.) has issued a readable but comprehensive pamphlet entitled "European Order and World Order". The principles on which the maintenance of Western civilization depends are summarized under four headings: freedom of thought, speech and movement; establishment of the rule of law both nationally and internationally; the progressive use of the State as an instrument of public welfare, not merely for policing or the protection of private interests; and the organization of production and distribution to raise the standards of living and of life of all peoples. Compromise on, or surrender of, any of these essential values endangers the stability of our whole civilization. The central problem for Europeans is to make clear those principles, to see that our institutions and policies conform to them and to place behind them an overwhelming and enduring assembly of forces.

The success of the totalitarian challenge has been due largely to lack of clear thinking and moral courage in the democracies. It has scarcely been recognized that peaceful change, in both domestic and international affairs, depends upon extensive research and planning, so that problems are seen and dealt with before they become chronic or acute, and before their reactions on other problems multiply. Technical and economic advances have made all countries so closely interdependent that the corresponding political advances can no longer be delayed.

While a crushing military defeat of Germany may not be necessary, it is vital that the basic principles of civilization represented by Great Britain and France should emerge triumphant. It has been necessary to reassert those principles in war because of recent failures to vindicate them in peace—failures which arose inevitably from the widespread attitude which insists on a complete divorce between economics and social needs, and at the same time has refused to face continuing after school age that blend of training and public propaganda known as education.

The fundamental task in reconstruction is to fill in these gaps in the use of economic power and of leisure, the existence of which has been exploited by extremist movements. Unless that is done, no political superstructure and no expression of ideals can save Western civilization from disintegration.

Much progress has recently been made towards the establishment of world economic security, particularly in respect of the basic raw materials and foodstuffs. Wheat, beef, sugar, tea, whale-oil, rubber, tin, steel, aluminium and other commodities are already controlled on a world-wide or a European basis, although most of the schemes are still very young. These schemes require extension and improving by securing their joint control by consumer and producer interests, and providing buffer pools under disinterested management, and by making them accountable to an international supervisory authority, such as a Permanent Cartel Commission of the League of Nations. Other steps in the same direction would be the establishment of international public utility corporations, comparable with the Tennessee Valley Authority, for backward territories, and the provision of international machinery for rendering raw materials available on special terms for particular backward areas, victims of aggression, or in times of national disaster, etc. The creation of international mechanism for rural loans, grants-in-aid and price insurance schemes are other measures suggested to relieve the want and insecurity of primary producers.

The idea of a division of the world into industrial countries and a much larger group of colonial primary producing countries is mischievous, and industrial development of all countries within their economic limits should be encouraged. Finance should be subordinated to trade and economic development. Again, the systematic development of social services, accompanied by competent economic and financial policies, would be a powerful aid to world order and could greatly increase the productivity of peoples burdened with ill-health. In education, as in the organization of the creative use of leisure or the development of colonies, there are large opportunities for international effort.

The logic of events in the economic and social fields is compelling an international approach and thereby inducing a reconsideration of the relation between nationalism and wider groupings. On the question of the federalization of Europe, the broadsheet touches but scantily, pointing out that our aim must be to create political forms out of which a fully developed federal system could easily emerge when the necessary degree of economic and political homogeneity in Europe has been attained. The problem of European order can and should be isolated within the problem of world order. Settlement of the first would simplify settlement of the second, particularly as large areas in other continents are European dependencies.

The term European order in itself raises the question, what is Europe, whether it should include or not Great Britain or the U.S.S.R., for example. No treaty or political mechanism can provide substitutes for courage, foresight, intelligence and integrity, but it is important that the settlement after the war should both express and further the unity of European civilization by a suitable mechanism, by economic stimuli, by education and leadership.

The broadsheet accordingly proposes that the settlement should include not only provision for common institutions and common funds, but also the formulation in broad terms of the essential conditions of European civilization, backed by organized publicity, as strong and as effectively watched as the police arm. The establishment of a standing European Council in appropriate relation with the League might lead to a start in financial and economic affairs. It would involve, however, a common policing agency for Europe or part of it, and also a specific agency for economic and social reconstruction, adequately financed. Many functions such as the improvement of communications, credit facilities, health services, education and research could be promoted more effectively by a European agency than by a host of national agencies.

THE COLONIES AND FOREST ADMINISTRATION

BY PROF. E. P. STEBBING

IN his Annual Forest Administration Report for 1938* the Conservator of Forests, Trinidad and Tobago, summarizes the forest policy in force. The clauses merit repeating here, for though they have been current in forest management in the British Empire for several decades, they have often proved to be pious platitudes rather than a carefully thought-out planning to which the Government concerned intended to adhere rigidly. The clauses are:

"(1) The permanent reservation by the Crown of suitably situated areas of forest of a total acreage sufficient to supply the benefits necessary for the welfare of the community—indirect benefits in the form of the maintenance of climatic conditions for agricultural crops, preservation of water supply, prevention of erosion and flooding, and so on, and direct benefits in the form of the supply of forest produce. (2) The management of these forests in such a way as to encourage the fullest possible utilization of their products on the basis of a sustained yield. (3) Such improvement of the existing growing stock as will enable the Colony in the future to become at least self-supporting in lumber."

There is nothing new in this. It may be found in one form or another in the forest reports and memoranda of every Colony. In the past, how much of these praiseworthy aims has been effected? It may be admitted that the Forestry Department in Trinidad in the past decade or so has received support from the Government which has enabled progress to be made in a correct forest administration. But even here the forestry question appears to be regarded not as a whole but as applying to parts of the country only. It is said that the general position with regard to forest reservation is eminently satisfactory except in the western portion of the Northern Range. In this district apparently the greater part of the land area has for many years been under private ownership, and until recently was mainly covered by cacao, forest or second growth. The Conservator, on the subject of this area, continues as follows:

"In the present depressed state of cocoa, land owners are renting out increasing areas of steep hillsides to agricultural peasants, who grow field crops, such as maize, tomatoes, etc., thereon, under a system of shifting cultivation. These peasants prefer the highest, steepest, and most inaccessible portions of the hillsides, as the danger of loss of crops by praedial larceny is thereby lessened. The abnormally high rainfall of 1938, coupled with the increase of clearings, was productive of erosion, flooding and landslides to an unusual degree, and revealed clearly the dangers of the existing situation. The problem is under investigation by the Lands Advisory Committee."

This description might equally apply, taking local conditions into consideration, to parts of West or East Africa, the Malay States, the Dominion of South Africa, and elsewhere.

* Council Paper No. 48 of 1939. (Trinidad: Government Printer, 1939.)

It is admitted that the utilization of local forest produce in Trinidad has not reached by a long way the maximum production permissible, either in the more or less pure mora (*Mora excelsa*) forests or in the natural mixed forests of the Colony. In the latter the complaint is made that the high cost of exploitation, owing to their small volume-production per acre of marketable species, is a factor contributing to the Colony's dependence upon imported soft woods. From a perusal of the report it would at first sight appear that this latter was a new problem. But it is one which has been in the past, and is at the present day, facing the forester in charge of tropical broad-leaved forests the world over. It is the business and duty of the trained forest staffs to devise methods of successfully dealing with this problem. But they require their Government to have a fixed forest policy, to maintain an adequate forest staff not subject to repeated fluctuations, and to make available adequate grants of money for development.

During the War of 1914–18, the Colonies and their forest services were offered a great opportunity. Imports of foreign timbers, chiefly softwoods, were cut off. They had to depend upon their own resources. Most of them realized their own weakness and incapacity owing to the paucity of their forestry staffs. These have been considerably strengthened since then, though in many cases they fall far short of what is required.

The Colonies are now offered a second chance. It may be suggested that the work which should be required from the forestry staffs in all the Colonies during the continuance of the war should proceed on two main lines: (*a*) Map and report all areas in the Colony subject to any and all forms of erosion, whether forest or agricultural (that is, in the form of shifting cultivation); (*b*) carry out an enumeration survey or stock mapping in all forests accessible, and likely to be accessible by means of a grant to open out communications, on a 5 per cent enumeration basis, of such species and only such species as from their locally known qualities are likely to prove saleable, over and above the timber species already of marketable value.

This work of primary importance to the Colony concerned has not been carried out in a detailed and concentrated manner, as is well known. The finance departments of the Colonies have not been able to see beyond the annual revenue produced from the forests; the staff have frittered time away over this revenue-hunting business; or in experiments with small areas of plantations, fuel and otherwise, necessary as this work may have been; and so forth. Since the War of 1914–18, a quarter of a century has passed and but small progress in the correct conservancy of its forest estates has been made by the Colonial administration as a whole. They are now given a second chance, with all the advantages of having clearly before them the opportunity lost twenty-five years and more ago. Will they profit by the lesson of the past and take it?

ORIGIN OF DEFECTS IN COPPER CONDUCTORS

MR. J. E. DEERING contributes a useful article on the origin of defects in copper conductors to the *Electrical Review* of October 3. When hard drawing became a common practice, copper wire became a practical substitute for galvanized iron wire for overhead telegraph and telephone lines. The effect of the process was to raise the tensile strength of copper from 6·5 tons to 20 tons per square inch, which is almost equal to that of wrought iron, whilst its resistance is only about one-sixth. The effect of the cold drawing of copper is to make its resistivity only about 3 per cent higher than that of standard annealed copper.

Most contracts for the supply of copper wire quote the British Standards Institution specification, which states that the wire shall be approximately circular in section, smooth, uniform in quality, pliable, free from scale, inequalities, 'spills', 'splits' and other defects. Mr. Deering states that representatives of purchasing firms engaged upon the inspection of copper wire may be able to detect physical defects and yet are often unable to detect their origin. The following consideration of the different stages of manufacture will greatly facilitate the tracing of the causes of shortcomings.

During its passage through a succession of rolls after it has been ejected at white heat from the furnace, a copper billet, initially measuring 6 ft. by 4 in. by 3½ in. and weighing 250 lb., increases in length as its cross-section diminishes. It emerges from the rolls at a greater linear speed than that at which it entered, for it not only takes up the speed of the rolls, but is also squeezed forward by an amount corresponding to the reduction in cross-sectional area. Rapid operation is necessary, as it prevents too great a difference in temperature of the metal from one end to the other, causing sometimes 1½ per cent variation in the tensile strength of the wire.

To ensure a reasonable temperature throughout the rod before being drawn into wire, it is 'roughly annealed' by heating at 1200° F. and quenching with water. It is then pickled in dilute sulphuric acid to remove mill scale. During the rolling, the shape of the cross-section is varied from pass to pass, for if the section were circular throughout fins would be produced; these would be bent over in the next pass to form 'cold shuts', which might be below the surface for a distance, and possibly remain throughout the complete process. A combination of shapes—squares, ovals and rounds—is therefore used, and this kneads the copper, rendering it homogeneous and ductile.

The next stage is the breaking down of the rod by pulling it through a dieplate with 12–18 holes. The dies are usually of steel, but for copper cast iron is sometimes used. For drawing long lengths of the wire, diamond dies are occasionally employed. Each hole has two zones—a short tapered one and a bell-mouth leading up to the approach. The walls of the latter must be quite clear of the entering wire, which might otherwise cause the metal of the die to be drawn forward and piled up in the throat.

A departure in circularity in section may occur during wire-drawing, if the wire has slipped on the drum of the coiling block, resulting in a 'flat' on the surface through rubbing. Lack of smoothness is sometimes due to the same cause. Non-uniform quality is traceable to impurities in the ore itself. Absorption of gases giving rise to blowholes when the ore is being smelted into billets may also occur. If during rolling a rod crowds a pass and issues with fins, these may become laid into the rod and show up as 'spills' on the surface. These are eliminated by 'scalping'.

The origin of 'splits' occurs in the smelting stage. If a fresh supply of metal is poured into a ladle which already contains a small amount of molten metal, the two will not mix or weld together. The seam or seal so formed will remain throughout the rod or wire being rolled and covered in later stages, so that it may appear on the surface at odd intervals. Two interesting photomicrographs are shown of a high-conductivity copper rod and of a section of the same rod after it has been made into hard-drawn wire.

BELGIAN EARTHQUAKE OF JUNE 11, 1938

THIS earthquake has been studied by O. Somville, chief of the Belgian Seismological Service (*Annales de l'Observatoire Royal de Belgique*, Série 3, 2; 1939). On June 11, 1938, at midday by the public clocks near the epicentre, an earthquake was felt in Belgium, North France, Holland, North-West Germany, Luxembourg and South-East England.

The shock reached intensity VII on Sieberg's modification of the Mercalli-Cancani Scale in central Belgium where it was strongest, and displaced tiles as far away as Herne Bay in England. The earthquake was the most intense of approximately 140 experienced in Belgium since the year 1086. At the Belgian Observatory at Uccle the Wiechert mechanical instruments were thrown completely out of gear, though the long-period Galitzin instruments with galvanometric registration gave the distance as between 50 and 60 kilometres from Uccle and suggested that the epicentre was to the north-west. This latter proved incorrect, as the epicentre by later calculations turned out to be between Audenarde and Renaix, almost west of Uccle. On a basis of 3,570 communications, isoseists were drawn using Sieberg's modification of the Mercalli-Cancani Scale, and two maps showing the

disposition of these are figured in the text, together with a map showing the point intensities in Holland.

It appears that altogether 17,550 chimneys were damaged, 3,000 in Courtrai alone, which represents 40 per cent of the possible number. There was no loss of life though ten people were slightly injured. Most people heard a sound as of the passage of a heavily laden cart, and several experienced two shocks, of which the second was the stronger. By the method of hyperboles the epicentre was found to be at geographic co-ordinates 50° 47′ N., 3° 35′ E., with an uncertainty of 4 or 5 km. A diagram of the determination is given in the text. The depth of focus, using the Mohorovicic tables of $\overline{P}$–P_n and Gutenberg's corrections, was of the order of 45 km., and this was confirmed by the formula for near stations.

$$\text{Time of propagation of } \overline{P} = \frac{\sqrt{h^2 + \Delta^2}}{V},$$

where h is depth of focus, Δ is epicentral distance both in kilometres, and V is speed of wave taken as 5·7 km./sec.

The initial time was calculated to be 10h. 57m. 42s. G.M.T., and it was found that north-east and south-west of the epicentre compression was registered first, whilst in the other two quadrants dilatation was initially experienced. Readings for P_n $P^*\overline{P} \alpha S_n$ and S pulses for twenty-four stations in Europe are given together with a graph, and seven of the seismograms are reproduced. Six notable aftershocks have been noted.

SACRED FEASTS OF THE FOX INDIANS

IN "Ethnography of the Fox Indians" by William Jones, edited by Margaret Welpley Fisher (*Bureau Amer. Ethnol., Bull.* 125; 1939), certain passages are tentatively identified with the contents of a sealed packet recording "ancient mysteries" of the Fox Indians, reported to have been among papers in the custody of the author's father (see NATURE of November 25, p. 914). These passages deal with "The Sacred Feast".

One kind of sacred feast is held in autumn, winter or spring. A man kills a deer and decides to pray. He informs a number of members of his own gens, say, the Eagle gens, of his intention, and each brings food, maple sugar, pumpkin, corn, etc. The prayer is held during the day, beginning in the morning. Waiters come to the lodge of the man getting up the feast and prepare the food; and invitations are then sent to others outside the gens. When the guests appear they find the Eagles waiting for them, seated at one end of the lodge, with the medicine bags spread out in front of them. They drum the air slowly with gourd rattles and chant songs. Before the first singing and while the food is cooking, the Eagles say to themselves to which spirit the food is sacrificed. The sprinkling of tobacco accompanies the mention of each spirit's name. A period of silence follows, then when the food is cooked the second singing and the eating begin. All food must be eaten before the fourth singing begins, and at the close of the fourth singing all the people disperse.

At the summer feasts in the summer bark lodges there is added dancing. As soon as the corn ripens, thanksgiving feasts are held to which each gens invites members of the different gentes. These services are religious, preparatory to the thanksgiving dances. Each gens holds two services at which newly gathered corn is eaten as well as the flesh of a dog killed for the purpose. The inviting gens does not eat, but does the praying to the manitou for his goodness in giving them corn. These services are purely religious and no one comes unless invited.

In the same manner in the dances, such as the Wolf or Eagle Feast dances, dog, the principal thing eaten, is an offering made to Manetowa to invoke his pleasure and presence at the dance, and no one comes to the dance unless he comes with the thought of coming into the presence of Manetowa. There is an atmosphere of sacredness; all enter silently and slowly, and there is no hilarity. During the dancing the men not taking part smoke or chew tobacco, while the women chew but do not smoke. The use of tobacco forms part of the rites to invoke Manetowa.

A feast is often held for the spirit of sickness so that he may not bring sickness. He has the power of granting long life. He is a manitou. Once a Winnebago—among the Winnebago, disease-giver was the most sacred of all their spirits—is said to have had the power of driving away the spirit of sickness. When the people were all dying of smallpox, he rode a white horse painted green and decked out gaily. He would run towards a house, yell at the spirit within, and strike against the lodge. This he did to drive out the spirit, and thereby gained many gifts.

Before a run is made on the buffalo, every camp makes a sacred feast to the buffalo, in which the food must be pumpkin or corn or maple-sugar; always sugar together with the other two if possible. Dog or any other kind of meat is not used. The feast is made as soon as the hunters know they are in the vicinity of the buffalo.

In the buffalo dance the men and women imitate the run and movement of the buffalo when in flight. The leader in the dance has his head covered by a buffalo mane. Dog, corn and pumpkin are eaten.

The Mowitihagi, "Dirty Little Ant", otherwise known as "Those who worship the spotted calf", is a society in which many of the members belong to the Thunder gens. It is a most important society, ranking with the gentes in some of the buffalo ceremonies. At its dance a small image of a buffalo made of stone is brought out from the bag in which it is usually kept and placed on the floor halfway between two fires. It is about 8–10 inches long and 6–7 inches high, of red stone, and in every respect a representation of a buffalo bull. It is said to be alive and a manitou. In the dance, tobacco is offered to it. It is brought out twice a year only in the sacred feast of the Mowitihagi.

SCIENCE NEWS A CENTURY AGO

The Observatory of the Rajah of Travancore

"We have seen with not a little pleasure," said the *Athenæum* of December 7, 1839, "an Astronomical Ephemeris, printed at the press of the Rajah of Travancore, and calculated for the meridian of the observatory recently established at Trivandrum, the capital of that State. Those who feel an interest in the intellectual progress of the people of India must be gratified to learn that the computations for this work were all made by native youths of Travancore, who received their education at the free school maintained by the Rajah. His Highness . . . came to a determination, in 1837, to establish at his capital an observatory of a superior kind; with the double view of affording his aid to the advancement of astronomical science, and of introducing, by its means, correct ideas of the principles of this science among the rising generation under his government. For the situation of Astronomer he chose Mr. John Caldecott, who, aided by Colonel Fraser, the British Resident at Travancore, decided on the plan of the building which is now erected, and which stands in latitude 8° 30′ 35″ N., longitude 76° 59′ 45″ E. Hitherto the observations have been carried on with small but excellent instruments belonging to Mr. Caldecott; but his Highness the Rajah intends to furnish it with the finest instruments to be procured in Europe, having, for this purpose, secured the services of T. Jones, T. Simms, and Dollond. . . ."

John Caldecott, who was born in 1800 and died in 1849, was the commercial agent to the Government of Travancore, but after the erection of the observatory devoted himself entirely to science. He was elected a fellow of the Royal Society in 1840.

Vegetable Monstrosities

THE issue of the *Medical Times* of December 7, 1839, contains the following note: "At the Linnean Society on December 3 the secretary read a communication from the Rev. Mr. Hicks describing some vegetable monstrosities recently met by him in the neighbourhood of York. They consisted in a union of two or more flowers into one, without any lines of junction whatsoever being visible, and in a multiplication of the stigmata, the pistils and petals of the plant—what De Candolle has denominated, with great propriety, an unnatural excess of fructification. In one or two species of iris and in a specimen of scrophularia nodosa, or sulphur wort—all which were exhibited to the meeting—the malformation of structure was strikingly apparent."

Iron Smelting in India

AT a meeting of the Asiatic Society on December 7, 1839, extracts from a journal by Captain Jacob, of the Bombay Army, were read. One of these referred to the process of iron smelting in the Mahabaleshwar Hills. The smelting was carried on in the most primitive way imaginable. The ore was dug from pits 20 or 30 feet deep, and in appearance was like rough gravel. The furnace was a hole in the earth lined with charcoal, and fitted with a clay oven. The bellows were two goat skins, worked alternately by the hand, and terminated in a clay pipe, which formed the nozzle. About three hours were required to smelt 12 seers of ore, producing about 5½ seers of a rough, drossy, impure iron, which lost about 2 seers more in being worked into its destined form. This quantity sold in the bazaars for a quarter of a rupee (less than a penny a pound). Better English iron was finding its way into the hills, at the same price or even cheaper.

Mortality in Malta

THE issue of the *Medical Times* of December 7, 1839, contains the following information: "From the absence of all malarious agencies the character of this island has been supposed exceedingly salubrious. The returns adduced, however, show that compared with Britain, the mortality is as 25 to 22 per 1,000 of all ages: among the troops during the 20 years antecedent to 1837 it averaged $18\frac{7}{10}$ths and the admissions to hospitals 1·142 per 1,000 of the force annually. Passing over the ordinary forms of disease, such as fever, ulcer, syphilis and others whose fatality in the tropics is proverbial, the prevalence of diseases of the lungs, in a climate hitherto supposed particularly favourable to persons predisposed to them, is marked as a singular circumstance. Consumption in particular carries off a larger population, both civil and military, than it does in the whole United Kingdom, for it appears by the bills of mortality that two thirds of the deaths are from this disease."

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

TEACHER OF ENGINEERING SUBJECTS—The Principal, Technical Institute, Ladywell, Dover.

UNIVERSITY GRADUATE to direct Institute of English Studies, Sofia—British Council, 3 Hanover Street, W.1 (December 14, quoting 'Sofia').

TEMPORARY FORECASTERS, Grade II (Male) in the Meteorological Office—The Under-Secretary of State, S.2.b. (Met.), Department Q.A., Air Ministry, Adastral House, Kingsway, W.C.2.

TEMPORARY METEOROLOGICAL ASSISTANTS (Male) in the Meteorological Office—The Under-Secretary of State, S.2.B. (Met.), Department Q.J., Air Ministry, Adastral House, Kingsway, W.C.2.

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

British Standards Institution. No. 853: British Standard Specification for Calorifiers. Pp. 60. (London: British Standards Institution.) 3*s*. 6*d*. net. [2011

Memoirs of the Cotton Research Station, Trinidad. Series A: Genetics, No. 15: (*a*) The Genetics of Leaf Shape in Diploid Cottons and the Theory of Gene Interaction; (*b*) The Genetics and Taxonomic Distribution of some Specific Lint Quantity Genes in Asiatic Cottons. By R. A. Silow. Pp. 239–298. 2*s*. 6*d*. Series B: Physiology, No. 11: Experiments on the Extraction of Sap from the Vacuole of the Leaf of the Cotton Plant and their Bearing on the Osmotic Theory of Water Absorption by the Cell, by T. G. Mason and E. Phillis; Studies on the Partition of the Mineral Elements in the Cotton Plant, 1: Preliminary Observations on Nitrogen and Phosphorus, by E. Phillis and T. G. Mason. Pp. 531–586. 2*s*. 6*d*. (London: Empire Cotton Growing Corporation.) [2011

Other Countries

Mémoires du Musée Royal d'Histoire Naturelle de Belgique. Mémoire No. 86: L'Ordovicien de Sart-Bernard. Par Eug. Maillieux. Pp. 60+3 plates. Mémoire No. 87: La biologie du domaine souterrain et la faune cavernicole de la Belgique. Par Robert Leruth. Pp. 506. Mémoire No. 88: Die subterrane Molluskenfauna Belgiens. Von Caesar R. Boettger. Pp. 68+1 plate. Mémoires Hors Série. Résultats scientifiques du voyage aux Indes orientales Néerlandaises de LL. AA. RR. le Prince et la Princesse Léopold de Belgique. Publiés par V. Van Straelen. Vol. 2, Fascicule 20: Gastropoda-pulmonata, Scaphopoda et Bivalvia. Par W. Adam et E. Leloup. Pp. 126+7 plates. (Bruxelles: Musée Royal d'Histoire Naturelle de Belgique.) [2011

An Indian Medical Review. By Major-General E. W. C. Bradfield. Pp. v+658. (Delhi: Manager of Publications.) 2.8 rupees; 4*s*. [2011